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ABSTRACT

The document contains 16 papers from the Institute for Deaf Blind Studies, a program to bring together many disciplines and to place emphasis on every aspect of the learning and teaching activity involved in the development of deaf-blind children. The following titles and authors are included: "Current Status of the Rubella Problem" (P. Ziring); "Audiological Considerations in Evaluating and Managing Deaf-Blind Children" (A. Dahle); "Developmental Evaluation in the Assessment for Rehabilitation Potential of Deaf-Blind Multihandicapped Children" (J. Brower); "Role of Sensorimotor Experience and Perception in the Acquisition of Language" (C. Groves); "Significance of Motor Development in the Deaf-Blind Child" (R. Folio); "Examining the Deaf-Blind Child--A Communication Gap" (R. Jose); "Instructional Materials for Use with Deaf-Blind Children" (J. Dyrda); "Developmental Assessment and Evaluation through Teacher Observation" (N. Barraga); "Environmental Coding--An Approach for Facilitating Cognitive Development in Deaf-Blind Children" (R. Jackson); "New Developments in Communication for Deaf-Blind People" (C. Laenger, Sr.); "Aids and Appliances for Employment and Rehabilitation of Blind and Deaf-Blind Individuals" (G. Dalrymple); "Programming for and Rehabilitation of the Low-Functioning, Nonambulatory Deaf-Blind Child" (B. Bell and C. Hain); "Helping Parents to Help Their Handicapped Child" (K. Hudson); "Interpersonal Aspects of Intervention Strategies in the Rehabilitation of Handicapped Children" (S. Mouchka); "Principles of Behavior Management, Disciplines, and Child Rearing Based on Three Psychological Theories" (M. Wyrick); and "Quality Education and Its Impact upon Rehabilitation Services and Their Probable Outcome for Blind and Deaf-Blind Students" (C. Raeke). (SW)

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Proceedings

The Institute for Deaf-Blind Studies

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Proceedings

The Institute for Deaf-Blind Studies

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Preface

The overall goal of the Institute for Deaf-Blind Studies was to bring together many disciplines and to place proper emphasis on every aspect of the learning and teaching activity involved in the development of deaf-blind children. The main objectives were the following:

1. Expand the awareness and knowledge of participants in the medical, motor, appraisal, evaluation, language acquisition, and parental-psychiatric areas.
2. Provide a stimulating environment conducive to the free exchange of innovative, creative approaches and ideas between participants and medical and educational consultants knowledgeable in working with multihandicapped children and their families.
3. Provide participants with knowledge of special materials on the market for use in teaching deaf-blind children.
4. Provide information on new materials and technology being developed for this population.

To accomplish the objectives, participants were asked to focus on the organism and how it functions, how feelings and attitudes affect its functioning, and what we can do as a team to meet the needs of multihandicapped children and their families.

Tomorrow is *NOW* for those who care; we hope you will accept the challenge.

HARLAND M. IRVIN, JR.
Director of Deaf-Blind Programs
Texas Education Agency
Regional Center for Services to Deaf-Blind Children

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Current Status of the Rubella Problem

Philip R. Ziring, M.D.
New York University

At the beginning of the nineteenth century, rubella (or German measles as it is popularly known) was recognized as a clinical disease distinct from other common rash illnesses such as measles or scarlet fever. However, it was considered little more than a clinical nuisance until 1941, when Norman Gregg, an Australian ophthalmologist, first made the association between congenital cataracts in newborn infants and an epidemic of rubella in the community about nine months earlier. Within a few years scientists around the world were able to confirm his suggestion that a mother who contracted this viral illness early in pregnancy might give birth to an infant with not only cataracts but defects involving almost every organ system.

In 1964 the most extensive outbreak of rubella in 30 years spread from the eastern seaboard to all areas of the United States. In the New York metropolitan area, more than 1,000 children were born with birth defects related to maternal rubella infection. In the country at large, an estimated 30,000 births were similarly affected.

Because of the special nature and the unusual magnitude of this problem, the Rubella Birth Defect Evaluation Project was established at New York University with the help of an emergency grant from the National Foundation–March of Dimes. To offer a comprehensive program to the affected families, a team of physicians, nurses, educators, social workers, and laboratory technicians was assembled. The number of patients followed in the program has gradually increased over the years to include more than 400 children.

In 1962 a new means of investigating this disease was made possible through the research conducted by two different teams of scientists who described the isolation of rubella virus in tissue culture. The serologic and virologic techniques that have resulted from this discovery have unearthed many new facts and provided physicians with a sound approach to the management of the problem of rubella in pregnancy and the evaluation of the child with rubella syndrome. The successful cultivation of rubella virus was followed by the development of a safe and effective vaccine. This vaccine was approved and licensed for use in 1969.

Postnatal Rubella

German measles is typically a mild illness in children and young adults; it occurs principally in the winter and spring months. The disease is characterized by a pinkish-red maculopapular, generalized rash lasting for about two to three days; however, the rash may be no more than a fleeting blush. In fact, rubella may occur without a rash in a significant number of children. Because they are not ill, children with subclinical rubella can continue their daily activities and disseminate virus throughout the community.

The rash of rubella has no characteristic feature; it is often indistinguishable from rashes caused by other viral infections or drug sensitivity. This diagnostic confusion has given rise to the popular, but erroneous, idea that individuals may have rubella many times. Exanthems may occur frequently in an individual person; however, for all practical purposes, rash illness due to rubella occurs only once. In fact, this is the basis for use of any rubella vaccine. There would be little value to immunizing individuals with a vaccine that did not protect them against subsequent attacks of the disease.

A troublesome feature of rubella in adults, occurring most frequently in postmenarcheal females, is aching joints. This complication can range from mild aching in one or two joints, lasting for a day or two, to full-blown arthritis with effusion lasting for a week or more. Fortunately, all cases of rubella joint involvement seem to be transient, and there is no evidence that rheumatoid arthritis or other permanent joint damage can result from rubella arthritis.

Congenital Rubella

In contrast to the usually benign illness that follows rubella virus infection in the child or adult the effects of this same virus infection on the developing fetus may be devastating. After intimate exposure to a person with rubella, a susceptible person may develop clinical symptoms and rash in approximately two or three weeks. Virus is usually present in the blood of the pregnant woman for about one week before the rash appears. It then rapidly disappears from the blood as antibody is produced, although it may persist in the nasopharynx and tissues for up to two weeks after the rash disappears. During the period of viremia, infection of the placental tissues may take place, with subsequent spreading to the fetal circulation and the multiplication of virus in virtually every fetal organ. The effects of such virus growth are dependent on the time during gestation that such infection takes place and the length of time the virus continues to grow in fetal tissues.

The complicated stages through which fetal organs pass on the way to maturity occur primarily from the second to sixth week of pregnancy. During this period rubella infection produces the highest incidence of defects of the heart and eyes. Therefore, after the eighth week of gestation, there is an abrupt decline in the incidence of cataracts, congenital glaucoma, patent ductus arteriosus, and other forms of congenital heart disease. On the other hand, the brain and inner ear structures continue to develop throughout pregnancy and remain susceptible to damage by the rubella virus when maternal infection occurs throughout the first and even the early part of the second trimester of pregnancy. In the last half of pregnancy, the placental barrier and the fetus' own immunity defenses seem to protect the developing tissues. Birth defects do not result from rubella late in pregnancy. In fact, we have not been able to detect evidence of fetal infection when such pregnancies come to term. In contrast, only a small percentage of the children in our study are free of some defect where the laboratory results have demonstrated fetal infection.

Clinical Manifestations

Widespread fetal infection with rubella virus results in involvement of virtually every organ system. Among 376 children enrolled in the Rubella Birth Defect Evaluation Project, the following major birth defects were present: deafness, 252; heart disease, 182; bilateral cataracts, 58; unilateral cataracts, 50; glaucoma, 12; psychomotor retardation, 170; and neonatal thrombocytopenic purpura, 85. Heart disease was the sole manifestation in 7 children, and deafness was the only defect in 68 children. I believe that many children who attend schools for the deaf, but who have no other abnormality (so-called "idiopathic deafness"), may in reality be children with congenital rubella.

Newborn Period

Full-term and premature infants may exhibit subtle clues which can aid the physician in making the diagnosis of congenital rubella; however, too often the mother is the one who notices that the child has "something" in his or her eyes or does not seem to hear. Since approximately 80 percent of the children in our study were shedding rubella virus, and therefore were contagious at birth, early recognition of this syndrome is vitally important to others as well as to the patient.

Neonatal thrombocytopenic purpura is the most obvious of these manifestations. The lesions may vary from red-purple, discrete macules measuring 3 to 8 millimeters in diameter and distributed all over the body (thus giving rise to the expression "blueberry muffin baby") to a scattering of fine petechiae, which are easily overlooked. This petechial eruption may be indistinguishable from that noted in the infant with neonatal sepsis, and, therefore, the rubella syndrome must be considered in the differential diagnosis of sepsis of the newborn.

The thrombocytopenia, with its resultant rash, usually resolves by the time the child is one month old. The most common clue to congenital rubella present in the newborn period is low birth weight for gestational age. Alert nursery personnel should suspect congenital rubella in any full-term infant whose birth weight is low or significantly lower than the birth weight of his or her siblings. If this is the case, one must then search for other evidence of congenital rubella. For example, in our group of children with neonatal thrombocytopenic purpura, 67 percent had heart murmurs indicative of congenital heart disease and 45 percent had cataracts. During this period X-rays of the long bones often reveal characteristic changes which consist of radiolucent streaks along the long axis in the metaphyseal portions of the long bones; these streaks give the bones a "celery-stalk" appearance. Neonatal hepatitis with jaundice also is noted frequently in the child with thrombocytopenic purpura. The death rate in this high-risk group exceeded 35 percent during the first 18 months of life.

Many newborn infants with congenital rubella appear to be perfectly normal in the nursery. In the majority of our patients, the effects of rubella during the mother's pregnancy only appear as the infant matures. Therefore, such children must be kept under careful surveillance until their full involvement can be determined.

Congenital Heart Disease

Patent ductus arteriosus, with or without stenosis of the pulmonary valve, pulmonary artery, or its branches, is the most common cardiac malformation observed in children with congenital rubella. Other defects of the aortic arch (aortic stenosis, coarctation, or ventricular septal defect) also are noted, but much less commonly. Congenital heart disease, including cyanotic heart disease, may represent chance association.

In most instances the cardiac defect is not immediately threatening to life. The children often can be observed until they are at least two years old before diagnostic studies are performed. On the other hand, a few children with congenital rubella decompensate in early infancy. In these children recurrent pulmonary infections and congestive heart failure with large left to right shunts require vigorous therapy with antibiotics, digitalis, diuretics, and oxygen. Death before the age of six months is not uncommon in this group. Cardiac surgery for patent ductus arteriosus, performed by an experienced team, frequently can save a life. After the cardiac defect is corrected, the infant may undergo an acceleration in growth and development.

Eye Defects

Bilateral or unilateral pearly cataracts, which are associated with microphthalmia, are the most characteristic, although not the most common, ocular manifestation of congenital rubella. These cataracts may be so small at birth that they may be missed easily. The cataracts result from direct virus infection of the lens of the developing eye. After birth the virus may persist in the lens for an indefinite period of time after it can no longer be detected elsewhere in the body. In one child studied the virus disappeared from all tissues by the age of eight months, but it still was present in cataractous material when surgery was performed two years later. The timing of the operation and the nature of the operative procedure for rubella cataracts have been matters of controversy. In my experience results were better when surgery was deferred until the eye reached sufficient size for the ophthalmologist to operate with some facility (usually when the child is approximately one year old).

Congenital glaucoma is a much less common manifestation of congenital rubella than are cataracts. Ten children with cataracts are observed to every one with glaucoma The cornea is large and steamy, and the intro-ocular tension is increased. Medication is not effective in the treatment of this defect, but prompt surgical intervention may yield excellent results. Delays in diagnosis or poor operative results often lead to blindness.

Retinopathy is the most common ocular manifestation of congenital rubella. In this condition discrete black areas of pigmentation, interspersed with areas of depigmentation, give the retina a "salt and pepper" appearance. The presence of this pigmentary abnormality has not been shown to interfere with normal vision; however, its presence in a child with a hearing loss or other birth defect strongly suggests the diagnosis of congenital rubella.

Hearing Loss

Deafness is the most common manifestation of congenital rubella. It may be the only defect present in the child whose mother contracted rubella after the eighth week of pregnancy. The hearing loss results from damage to the organ of Corti, and it is a permanent, sensorineural type of loss. The loss may be unilateral or bilateral, mild or severe. Early diagnosis of hearing loss by experienced audiologists is critical for the rehabilitation of the deaf child.

When the hearing loss is detected in infancy, amplification with hearing aids and early initiation of appropriate auditory training can help the child to develop speech. The earlier these measures are instituted, the better the result. Children under the age of one year can begin training programs.

Neurological Defects

Almost one-half the children (170 out of a total of 376) in our program manifested evidence of retarded neuromotor development. This covers a broad spectrum, encompassing minimal intellectual impairment, hyperkinetic behavior, severe mental retardation, or typical cerebral palsy. Here again, intrauterine rubella virus infection may be responsible for a variable amount of brain injury, both by preventing appropriate development of neural tissue and by destroying healthy tissue already formed during the prenatal and postnatal periods.

These children often do not "catch up" to those with a normal level of functioning; however, the prognosis of these children frequently is better than what one might predict during infancy.

Education and Rehabilitation

Infants with congenital rubella are adrift in a lonely world. They are not only deprived of vision by cataracts but they are deprived of the ability to hear by sensorineural deafness. Without early intervention by an experienced multidisciplinary team, this isolation from the rest of the world becomes more and more difficult to breach. The chances of success through rehabilitative measures diminish progressively as the child matures; therefore, early case finding is essential. Too often congenital rubella is regarded as hopeless from the outset. Auditory training and amplification of sounds must begin in infancy. Surgery to restore useful vision must be undertaken at the appropriate time by an ophthalmologist who is experienced in dealing with such congenital defects. Physical medicine and orthopedic services should be provided to children with spastic deformities. Special educators must play an important role in designing and staffing programs of rehabilitation, and family counseling is especially critical during the early years. Young children should not be consigned immediately to minimal care, custodial-type institutional facilities for the severely retarded before they are evaluated in an educational and rehabilitative program.

Vaccine

In 1966 Parkman and Meyer of the National Institute of Health reported the development of the attenuated HPV-77 strain of rubella virus for use as a vaccine. Extensive studies revealed that the vaccine was well tolerated and immunogenic. The vaccine-virus was not communicable. Two derivatives of this rubella vaccine, HPV-77DE$_5$ and HPV-77DK$_{12}$ have been licensed for general use.

The major thrust of the rubella vaccine program has been directed at preschool-age and school-age children. Immunizing this ambulatory susceptible group hopefully will decrease the number of susceptible persons left in the population to serve as a reservoir for another major rubella epidemic. Widespread use of this vaccine has been encouraged by a number of governmental and private agencies. In New York City alone, more than 300,000 doses of vaccine, supplied without charge through the New York City Department of Health, have been administered to young children in the schools and day nurseries.

Under carefully controlled conditions vaccine has also been administered to women; however, the side effects of rubella vaccine have been more common in this group than in children. Vaccination of adult women causes transient pain in the joints or swelling, which follows a pattern similar to that observed after natural rubella.

It is not known whether rubella vaccination of a susceptible pregnant woman could provide anomalies in her developing fetus. Therefore, no woman of childbearing age may be considered for rubella immunization unless one is certain that she is not pregnant and will not become pregnant for at least two months after vaccination. Obviously, this characteristic of rubella vaccine rules out any type of mass campaign of rubella immunization for women of childbearing age.

Fortunately, most women in the United States are immune to rubella because of infection in childhood. As the rubella hemagglutination-inhibition (HI) antibody test becomes widely available, the time may come when women will learn of their rubella immunity status when they apply for a marriage license. The same blood sample obtained for syphilis serologic testing could also be studied for the rubella antibody. The women found to be susceptible to rubella could receive the special attention they deserve. The others (the majority) could be reassured that they were immune to the hazards of rubella in pregnancy.

Audiological Considerations in Evaluating and Managing Deaf-Blind Children

Arthur J. Dahle
Regional Center for Services to Deaf-Blind Children

The first national workshop on the evaluation and management of deaf-blind children was held in New York City in 1970. That conference represented a major effort to focus the attention of professionals from many disciplines on the task of providing habilitative services for the large number of deaf-blind children born during the 1964 rubella epidemic. Today's conference indicates that a need still exists to address the problems of deaf-blind children.

Working with a deaf-blind child is certainly not an easy task. In fact, I can think of few other disorders which present as much of a challenge to our professional expertise and resourcefulness. My goal today is to discuss some of the problems and considerations the audiologist faces in evaluating and managing deaf-blind children. I also want to provide information that should lead to a better understanding of auditory impairments.

The initial step in evaluating a child with a hearing loss is to determine the type and degree of impairment. One must determine if it is a conductive loss, which often can be corrected through medical treatment or surgery, or if it is a sensorineural loss, which indicates that there has been permanent damage to the inner ear or the higher auditory pathways. Also, one must determine the level of hearing sensitivity and the extent of the child's residual hearing. Basically, one must answer the following question: "What can the child hear, and how well does he hear it?" The first part of the question relates to the degree of hearing loss. The loss may be so moderate that the child can hear speech and most environmental sounds, or the loss may be so severe that the child has virtually no usable hearing. The second part of the question relates to the quality of the child's residual hearing. In other words, how well does the child utilize his or her hearing ability? This is an especially important consideration when the child is being fitted for hearing aid amplification. For example, some children may have difficulty adjusting to a hearing aid because their impairment causes sounds to be distorted and irritating. This auditory function is very difficult to evaluate in young children, and in most cases it can only be inferred indirectly through observation of the child's behavior.

Assessment of Hearing Sensitivity

Hearing sensitivity in infants and young children is usually assessed by behavior observation audiometry. Essentially, this procedure involves presenting the child with pure tones, speech, and other environmental sounds through loudspeakers in a soundproof room. The examiner observes the child's responses to the various stimuli and records the intensity level at which they occur. The validity and reliability of this procedure is of course dependent upon eliciting an easily recognizable response such as turning the head or eyes to search for the source of the sound. Frequently, one must rely on more subtle responses such as cessation of movement or other slight changes in behavior; however, the use of visual reinforcers, e.g., flashing lights or animated toys, often can aid in eliciting more consistent behavioral responses.

As the child matures and is better able to cooperate, earphones are used to obtain pure-tone thresholds for each ear by means of operant conditioning procedures or play audiometry. The child is taught or conditioned to make a voluntary response to speech or pure tones. The task should be simple, such as dropping a block in a box at the onset of a sound. For deaf-blind children the situation must be structured so that they can grasp the concept through proprioceptive and tactile sensation. Although the procedure is relatively simple, many children require extensive conditioning to establish a consistent response. Teachers and parents can aid the audiologist by teaching the task at home or in the classroom.

Impedance audiometry is a relatively new audiological procedure; it provides an objective measure of middle-ear functioning along with a gross estimate of hearing sensitivity. This test can be used reliably with infants and young children, and it is particularly valuable for identifying or ruling out middle-ear pathology. Recent modifications also make possible an estimate of the degree and slope of hearing impairment. This estimate should be useful in the assessment of deaf-blind children.

Evaluation

Thus far, I have touched on only a few of the problems that arise in evaluating the hearing of deaf-blind children. Certainly, many other problems can force audiologists to modify their traditional procedures. We have found that many young deaf-blind children have very short attention spans and are easily distracted. The opposite problem may sometimes occur when children become so engrossed with a toy or activity that they completely ignore auditory stimuli. Personally, I am curious as to why many deaf-blind children seem to often completely ignore or "tune out" their auditory environment while, at the same time, they appear to display an almost insatiable need for visual stimulation; however, this behavior often is used to advantage in the evaluation of children. For example, in using operant conditioning audiometry, we have found that strong visual stimulation often serves as a powerful reinforcer. Visual and auditory stimulations can be paired in teaching a child to respond to sound. Generally, an attempt is made to take advantage of all sensory pathways in trying to condition the child to respond to the test procedures. Thus, we may simultaneously present tactile stimulation by a bone conduction oscillator along with pure tones and a light in the initial conditioning stage. Gradually, the tactile and visual signals are faded out when the child begins to respond consistently to the auditory stimulus.

Deaf-blind children may have to be evaluated several times before the degree and type of hearing impairment can be determined accurately. This extended evaluation period sometimes poses a dilemma for the audiologist in terms of making recommendations for hearing aid amplification. We realize the importance of providing amplification at the earliest possible age; however, we must be reasonably sure of the degree of loss, or we run the risk of damaging the child's hearing by using an aid that may be too powerful. At this point clinical experience must be used to make a judgment on whether to proceed with the selection of a hearing aid.

Selection of Aids

The first step in the selection of an aid is to determine the amount of amplification that would be appropriate for the child's hearing loss. Generally, we select an aid that provides a gain level equal to or slightly greater than the degree of hearing loss. Thus, a child with a 50-db loss would need an aid that provides at least 50 db of gain in amplification. Most hearing aids are limited to 70 db or less gain. This means that a hearing aid can never completely compensate for a severe or profound loss.

The second major consideration in selecting a hearing aid is to determine the frequency response that is most suitable for the individual's particular type of loss. Most persons benefit from a response pattern that approximates the configuration of their loss. For example, one would select an aid with a high-frequency emphasis for a person who has a greater loss in the higher frequencies. Fortunately, most hearing aids have adjustments that allow for changes in the frequency response pattern. One thus can try different settings on a trial basis before a final determination has to be made.

If possible, all phases of the hearing selection process should be carried out on a trial basis. It is sometimes very difficult to determine in a clinical setting whether or not a young child will benefit from amplification or even accept the use of an aid. An extended trial period with a hearing aid or auditory trainer often is the only way to ensure that the child's needs for amplification are being met.

In some cases, children will readily accept the use of a hearing aid and do well with little formal training. Most often, however, children will benefit from a structured program of auditory training designed to develop their residual hearing to its fullest extent. The general goal is to make auditory experiences meaningful for the child. The child must learn that some sounds signal danger, whereas other sounds are associated with comfort and love. He or she must learn that speech sounds are useful for gaining contact with people who are in a position to satisfy his or her needs. Most of all, the child must learn to use audition as a means of establishing communication with other individuals. The first step in making auditory stimulation meaningful is to develop an awareness of sound. Initially, the child may only be able to indicate the presence or absence of sound. As awareness increases, the child can move on to learning to identify sounds and to discriminate among sounds that have similar auditory characteristics. The ultimate goal would be to have the child recognize and discriminate speech sounds. Auditory training programs should focus on developing awareness and recognition of sounds that the child would normally experience at home or in school. The principles of behavior modification can be used in teaching a child to become more aware of sound. Consistent, positive reinforcement for attending to auditory stimulation especially helps to develop better listening skills and serves as a mechanism for developing receptive language. Auditory training should not be thought of as an isolated step in aural habilitation. The child will need continuous help in learning to better utilize his or her hearing in all educational settings.

When working with a child who is using a hearing aid, the teacher should remember that the instrument will amplify all sounds and not just those the teacher wants the child to hear. Classroom teachers must be especially alert to see that extraneous noise is held to a minimum. Carpets on the floor, for example, will greatly reduce the sound of shuffling feet and moving chairs. When an air fan is set at a lower speed, its interference with hearing will be significantly reduced. In short, one should do everything possible to provide an acoustic environment that reduces distracting or extraneous sounds.

Another point to remember is that the intensity of sound at the microphone of the hearing aid is directly related to the distance from the sound source. The greater the distance, the less intense the sound. Studies have shown that individuals with hearing aids can understand speech much better from a distance of 3 feet than from distances of 6 and 9 feet. For this reason, a wireless FM transmitter system is probably more effective for use in a large classroom. With this system the intensity of the teacher's voice never varies, and each child is assured of hearing at the intensity level best suited for his or her loss.

Variations in Hearing Levels

Now I would like to shift emphasis to discuss the variations observed in hearing levels of deaf-blind children. The term "deaf-blind" often is a misnomer. Seldom does one find a child who is completely deaf or completely blind. Part of the difficulty in choosing a label lies in how one defines deafness. Hearing impairment may be categorized solely on the degree of loss in decibels. When this is the only basis that is used, losses of 85 to 90 db or greater usually fall in the deaf category. We know, however, that individuals with this degree of loss vary greatly in their ability to function in a hearing environment. A more useful procedure might be to categorize hearing impairment on the basis of functional ability. For example, Silverman and Davis provide a social criterion for deafness, which is defined as occurring when "everyday auditory communication is impossible or nearly so." Similarly, the National Deaf-Blind Registry uses an educational criterion that defines deaf-blind individuals as those who "have auditory and visual handicaps, the combination of which causes such severe communication and other developmental problems that they cannot be properly accommodated in special education programs for the hearing impaired or blind."

The definitions allow for a wide range in hearing sensitivity, and our studies have shown that the degree of impairment among children in programs for the deaf-blind varies greatly. This fact is extremely important to remember because our evaluation and remediation procedures may be quite different for a child with a moderate loss than they would be for one with a profound hearing impairment. Because of the great variation in degree and extent of the multiple problems of the deaf-blind, these children must have individualized habilitation and educational programs that are geared to take advantage of the modes of communication most appropriate for each child.

Changes in Hearing Sensitivity

We must also be on guard for changes in an individual's hearing sensitivity. This is especially true for young, difficult-to-test children. We recently found a significant improvement in hearing sensitivity for a youngster who was referred to our program at one year of age. At that time, he was wearing a powerful body hearing aid, and previous audiological evaluations indicated that he had a profound bilateral sensorineural hearing loss with residual hearing present only for frequencies below 1,000 hz. The initial test results also showed the presence of a profound loss, but residual hearing was found to extend out to 2,000 hz. Because of a history of chronic colds, allergies, and frequent earaches, the child subsequently had a myringotomy to remove fluid from his middle ears. An evaluation performed a few weeks later showed only a slight improvement in sensitivity for the lower and higher frequencies; however, a dramatic change in test results occurred in our latest evaluation, which showed hearing thresholds for all frequencies to be in the mild-to-moderate (40 to 50 db) range. Thus, in a period of a year and a half we saw a change from a profound hearing loss to a mild-to-moderate impairment.

Developmental Evaluation in the Assessment for Rehabilitation Potential of Deaf-Blind Multihandicapped Children

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From the point of view of the present examiner, or assessment person, the initial evaluation of a multiply handicapped infant or child serves several very crucial purposes if it is to be of any value at all. By the time a child arrives at the psychologist's office, for purposes of developmental assessment, much is known regarding the hard, physical deficits, with the possible exception of actual visual and/or hearing acuities, the latter due to an inability of the child to respond to the normal assessment procedures and tools. The very basic task before the evaluating person is to attempt to sort out the presence and strength of assets in light of known medical liabilities. This task of sorting out factors becomes increasingly difficult as the disability is more severe; however, these severely affected children and babies are the real challenge to assessment and rehabilitation personnel of all descriptions and disciplines. Before one can work effectively with severely damaged youngsters, some sort of personal commitment is necessary. This is the type of commitment that would allow one to be able to immediately respond to such questions as "Don't these kids depress you?" or "Can you really do anything with them?" The primary goal is, of course, to prepare and condition the handicapped child so he or she will be able to take part in and benefit from some type of rehabilitation program. In such a program the child's potential would be exploited fully.

Assessment of Potential

The assessment, from a rehabilitation/education viewpoint, is basically a determination of the level of functioning of the child so as to ascertain where to start (determination of baselines) and also, along a time continuum, to be able to determine if teaching has been successful. This is also the basic model used for assessing all children, the real difference being that almost all of our evaluative procedures are based upon normal development, or maturation within normally developing children. Known child development patterns still must be the measuring rod which we use, despite the very real deficits which we know exist in our population. We still must have an appreciation of the normal growth and maturation continuum before we can really begin to appreciate where, within this continuum, the damaged child belongs at any given time. Sensory losses of any significance further complicate the picture to a great degree; however, the same principle still applies because it has been this observer's experience that blind and deaf children also develop according to discernible patterns, again depending upon native potential ("intelligence," if you will) and any and all organic and/or emotional factors interfering with the exploitation of this potential.

To establish valid criteria for the initial assessment of a deaf-blind individual's educational-rehabilitation potential is difficult; however, every evaluation unit, either formally or informally has been accruing experience and data on children with similar handicapping conditions and within similar preschool environmental situations. The assessor can easily identify those children who are severely mentally deficient; however, the majority of children who are evaluated tend to fall within the extremes of those children who manifest very adequate learning abilities and those who are profoundly retarded or totally untrainable from an educational point of view. As more children are observed, evaluative data should become more predictive and the assessment itself more consistent and more meaningful in providing information for parents and for those who will be working with the children. Assessment of the developmental/rehabilitation potential is really not helpful if it cannot be predictive and if it does not in some way result in a methodology for actual exploitation of this potential. Newer, more promising techniques of educating and managing children with severe neurological and/or emotional problems, together with more efficient and consistent methods of assessing these children, should be used as a continuing process. In this sense the teacher becomes an assessor who introduces new concepts into the evaluative procedure and advises classroom personnel and parents when and how to incorporate these concepts into either a formal program or within the daily living situation.

Concept Development

During the course of the present institute, you will hear the term "concept development" many times. It is included in the present discussion because this is basic to acquisition of skills in all maturational areas and across a broad continuum that includes all visual and auditory perception to any and all degrees. In this sense we are assessing acquisition of human skills, and thus we must base the results we achieve with a particular child upon the knowledge we have of growth and development among human babies. Concept development is based upon the child's awareness and knowledge of his or her complex environment, including physical, social, and cultural aspects. Individuals need to understand their environment and their relationship to it. To gain this understanding, the child needs to learn to utilize all intact senses and whatever residual abilities remain in the impaired senses. Proficiency in the skills of sensory awareness or perception and discrimination will assist in developing the child's body awareness and spatial awareness, and will thus assist in increasing understanding and, more important from a concept development viewpoint, in interpreting the surroundings in order to integrate them more effectively into a global sense of self or ego. As do all growing, maturing humans, deaf-blind children learn sequentially. They begin to learn at birth (or earlier) and continue to make refinements throughout life. Because learning is a systematic, life-long process, the basic chore of an evaluator or assessor, at any given time in the learning sequence, is to ascertain a child's potential to progress through the continuum. The evaluator tries to pinpoint where the child is along several parameters of the growth sequence. Most importantly, the evaluator recommends methods of enhancing and stimulating growth and compensating for both intellectual and sensory impairment, plus behavioral pathology if such applies. To achieve meaningful and efficient development of various daily living skills, the child must have realistic concepts of his or her environment. The child must develop an awareness of his or her relationship to the environment. When this awareness has been achieved, the child's attention span must grow to maintain contact with the significant sensory realities to further gain information and interact with them. This necessitates that the child must develop the process of gathering, recognizing, and interpreting the available sensory information in meaningful and useful concepts. In this respect concept development is operationally defined for the population upon which we are focusing. Again, this process is a developing, broad one, which crosses the borders of a variety of maturational areas, encompassing language development, motor skills and mobility in space, emotional development, and the child's concepts of solid objects and their meaningfulness to him or her.

Concepts of form are thought to be among the first to emerge as children grow. Within the first few months of life, youngsters recognize familiar faces; as time passes, language permits the codification of impressions (mental integration and synthesis) and thus the formation of action into simple words. "Bye-bye" is an action-laden concept with its own very special flavors. General mental and experiential maturity obviously influences the course of such development; the life-space and experience of children, including sensory input via auditory and visual cues, are the raw data and material from which concepts are formed, and the cognition processes (learning) are the actual reformulation of those data as situations and environments change (carry-over of learning). In this light, the evaluator-assessor must again attempt to pinpoint in the child where along the continuum of data coding and reformulation he or she does function and will be able to continue to do so given optimal opportunity. This opportunity includes formal teaching personnel and setting, availability of evaluation for and acquisition of prosthetics for maximal usage of auditory/visual acuity, and an environment within the family for sound emotional growth and emerging control of obtrusive behaviors that plague and confound the situation within our deaf-blind population. In this respect the initial assessment is the very beginning step, no matter when it occurs within the child's chronological life, of a long process of rehabilitation; in this sense the term encompasses the acquisition of all the skills necessary for adapting to the environment, given the neurosensory deficits and behavioral problems. If the population were not a handicapped one, the term rehabilitation would not apply and the term education or maturation would be substituted. Therefore, this examiner views rehabilitation to include all those processes which can be brought into play, both evaluative and educational, in order to initiate and enhance the process of concept development within the multihandicapped population of children and adolescents (and indeed young adults as well).

The relationship between sensory impressions or perceptions and the gaining of concepts becomes a major concern when two sensory modalities are reduced. To increase the probability that a concept is understood, a deaf-blind child will need to have repeated confrontations with a particular stimulus in order to refine ideas; at the same time each concept or basic idea must be so defined and somewhat firm in the child's mind (integrated) as to allow more complex concepts to be realistically and meaningfully defined (mental synthesis). If the multihandicapped, sensory-deprived child's perceptions are to be meaningful and realistic, there must be a conscious effort by those responsible for his or her education, including the family, to guide and direct his or her experiences. Learning will not be automatically accomplished, to a large degree, as it is with most sensorially normal children. To be internalized, each experience will need to be repeated periodically to refresh the memory and to provide the opportunity to refine concepts and build upon them, thus constructing a repertoire that is a set part of the child's maturation and intellectual growth.

Sensory Expressions

The developmental assessment, again, attempts to locate along the maturational continuum where a particular child has learned or at what level he or she has been able to translate and comprehend what is perceived via any sensory input modality, or any combination of modalities. Although formal communication may be limited or nonexistent, the child can receive information through various senses to some degree, thus developing inner language, which itself serves as a basis for later receptive and expressive language. In this way concepts are built through sensory expressions; as a child begins to differentiate his or her environment, he or she must gain meaningful concepts about common objects within the immediate surroundings. He or she becomes aware of them, recognizes them and then, and this is the most important bridge to formations of concepts, he or she must interpret them in order to be able to use this information in a similar situation. To be able to go through this process, the child will initially need to experience the real object in a meaningful manner; it is necessary for the object to have a purpose that is comprehensible and meaningful to the child. Developmental assessments must then also be informative to the extent that the educational personnel thus know where to begin with a particular child in his or her comprehension of objects within the environment.

The basic premise is that when the deaf-blind child can use his or her available sense modalities to receive information and can understand some of the basic concepts about people and objects, then he or she will learn to exist more securely and independently. It has been the present assessor's experience that there is a tremendous reduction in symptoms of anxiety within individual children when concepts have been perceived and comprehended and when the maturational continuum has been achieved. They become dramatically less overtly disturbed and disturbing, becoming more stimulated by actual environmental events as compared with the entirely self-stimulatory or passive receivers of environmental activities. As children become more secure, they are surely more available and open to learn more.

In the assessment of a deaf-blind child both the remaining and residual senses need to be tapped. Eventually, the child must learn to use all of his or her senses efficiently to be aware of his or her surroundings; the child must be allowed to interpret the information received through the senses in a manner which is meaningful to him or her, whether or not it is the manner or meaning deemed most correct by the adult. In this sense tests and instruments used to interpret a child's level must be altered or adapted in such a way as to compensate for significant sensory loss (e.g., visual items substituted for auditory items on developmental checklists, or some other obvious or not-so-evident substitution with similar levels of development assigned). To evaluate children, one must find where development of a particular sense has occurred within the following phases: (1) awareness of the stimulus; (2) tolerance of the sensory stimulus; (3) recognition of the stimulus; (4) interpretation of the stimulus; and (5) application of the meaning or purpose of the stimulus. Tolerance is the child's permissiveness toward contact with the stimulus, usually begun with short exposures in time and involvement until the child will allow contact or presence of the stimulus for a period of time sufficient for him or her to become aware of its characteristics. Awareness is simply his or her realization that the particular stimulus is something with which he or she has had previous contact. Interpretation includes the recognition of the stimulus and its purpose; application is the child's appropriate use of the stimulus. Again, it is the role of assessment to be able to determine within which phase a particular child seems to be able to function for several sensory modalities, and thus to present a developmental picture that can be meaningful to those responsible for formulating and carrying through educational and rehabilitation programs.

Developmental Examination

The developmental examination itself can be considered as a type of survey which attempts to collect data regarding the child's conceptual or cognitive skills within the two broad categories of auditory/language and visual/perceptual reception and expression. As discussed previously, the primary factor under consideration is the aspect of concept development along the developmental continuum in the various areas we attempt to analyze, using normal child development principles as a reference despite the obvious difficulties in setting standards for the deaf-blind population. This is increasingly difficult when we take into consideration that many of these children are also brain impaired to a degree which connotes severe learning disabilities as well as the maturational-educational problems associated with the sensory loss itself.

The following discussion will illustrate the manner in which part of the Roosevelt Hospital rubella project team evaluates each child within the developmental areas. The team usually includes, besides the pediatrician and pediatric psychologist, an occupational therapist, an early education specialist, a public health nurse, and a social worker. We attempt to meet beforehand in order to discuss aspects of the case. We meet with the family and patient. Each team member makes his or her own observation at once or with the child, apart from the rest (depending upon the circumstances), and then the team meets together for several moments once more before discussing with the parents the findings and short- and long-range future planning. The team often meets after the family leaves in order to summarize and record while the entire session is fresh and the general effect is still present.

The developmental categories, according to disciplines present and involved, basically include: (1) language development; (2) fine motor and sensorimotor development; (3) gross motor development; and (4) social and emotional development.

Language Development

The language developmental category includes inner language, receptive language, and expressive language.

Inner Language

Children use inner language when they communicate with themselves, based upon the degree to which concepts have been integrated mentally. One simply observes what a child does with common objects such as a doll, a bottle, a comb, or a brush. The degree to which the child can handle these objects appropriately is noted.

Receptive Language

Receptive language is the area of language which deals with perception of what word concepts connote, from very simple associations to complex ideas such as comprehending principles and other abstract concepts. Object recognition is the primary level, moving from that to recognition of body parts and identification of representations of objects. More complex indices of language comprehension include understanding the multistaged commands, prepositions (objects in space), letter and number concepts, and time sequences.

Expressive Language

Language is expressed in several ways, including both vocal and gesture; it is basically the manner in which a child communicates within his or her environment, and to what degree he or she has become efficient in doing so. The sequence begins with mere vocalization, goes on to imitation of sounds and vowel-consonant combinations and to assigning sounds to objects and concepts. Deaf children, of course, go through the sequence in a logical or ordered manner, but one that is unique compared to that of hearing or partially hearing children. Gesture and "signing" are as much expressive language as is vocal language.

Fine Motor and Sensorimotor Development

Fine motor tasks are prerequisites for other learning tasks. Eye-hand coordination goes hand-in-hand with fine motor tasks. For the multihandicapped child many of the tasks presented within this category are difficult. The child often has difficulty crossing the midline, planning fine motor movements, and integrating the two sides of the body (coordinated bilateral movement). This child also tends to have a poorly developed pincer grasp; this interferes with the child's ability to manipulate objects. Despite real problems, the child's fine motor development is a critical area in development. For example, a deaf child must be able to use the fingers for spelling. An oral child must be able to manipulate and imitate fine speech movements with the tongue and lips if he or she is to use oral communication. In effect, all readiness and academic tasks presuppose that the child has fairly good fine motor skills. The task of the examiner is thus to assess finger and hand usage, as well as eye-hand coordination, if the sensory level makes these observations possible while observing concept development. Examples are object sorting, block building, object counting, using pegs and formboards, and the like. The highest order skills are the graphic tasks, such as copying geometric figures and then perhaps cutting them out with scissors.

Eye-hand coordination may be further defined as the ability to first grasp and then to steer visually an object through space to accomplish a given task. Again, observation of such a complex sequence enables an examiner to assess several areas of developmental parameters. Cognition comes into play because mastery of eye-hand movement patterns is essential to the child's ability to physically interact with the objects within his or her environment, to actually manipulate them, and to probe them. They are, therefore, a significant factor in his or her cognitive development. As with all skills, eye-hand coordination follows a definite progression or development, moving from the ability to use the eyes and hands to reach out and grasp objects to the coordination of the eyes and one hand in performing a task (unilateral function), to the coordination of the eyes and both hands, and finally to the coordination of the eyes and hands in the ability to use tools as extensions of the hand. Again, as an examiner tests for eye-hand coordination, he or she is also able to examine cognitive and concept development via the nature of the objects, tasks, and tools; at the same time, language may also be observed (inner, expressive, and receptive), thus enabling the examination itself to be a smooth, coordinated event for child and family. One examines for baselines and upper limits of ability, progressing to a more complex function only if simpler, basic ones have been mastered; in this manner, the examination is also a training session.

Gross Motor Development

The evaluator must observe the manner in which the child uses his or her own body in space; a prerequisite is some form of body concept. Before a child can relate to another person or thing, he or she must first have an awareness of "self." The child needs to discover how his or her body moves; he or she has to be able to sort out one part of the body from another, progressing to such concepts as handedness and distinguishing right from left, the latter representing a high order of language and motor complexity. Children start to develop an awareness of their bodies during infancy; this awareness continues to grow as do other areas of cognition and recognition. The multihandicapped child often develops no stable image of self; he or she is often unable to locate his or her body in relation to other objects, nor can he or she locate other objects in relation to his or her body. If a child is able to develop a good self-image, he or she will have a sound base upon which to build the perceptual skills which will be needed before he or she can perform regular classroom activities. A child must further be able to identify his or her body position with that of his or her surroundings (space) and then realize the course of movement which he or she must follow in order to change from his or her present position to his or her destination (direction). Mobility within space also involves visual and/or tactile memory plus auditory memory, with hearing children.

Examination for gross motor function involves observation of such areas as head control, rolling, and sitting in infants, to the more mature reciprocal motor activity involved in crawling, standing, cruising, and walking. The higher order skills include imitation of body movements, ball play, and balancing skills. Again, the neurological functions must be sorted out from the factors that are primarily intellectual or that are based upon cognitive deficit.

Social and Emotional Development

The area of social and emotional development is a very broad one, encompassing both the psychiatric and self-care categories. The literature and information being gathered by our own project and others around the country indicate that the children who are multi-impaired (especially along sensory deprivation modalities) develop significant emotional disorders. The recurring terms such as "autistic-like behavior" or "reactive emotional disorder" are good examples of this. It is difficult for these children to relate to and thus please either themselves or significant others around them. They are initial disappointments and objects of anger and guilt to their parents, especially mother. Normal infant-parent love-making is grossly restricted; this is usually a chronic phenomenon. These social/emotional problems often are as disabling as the physical/intellectual deficits; these are the nonphysical aspects of disability and deserve the same degree of attention as the physical and cognitive problems, both in an evaluative and rehabilitative sense. Their evaluation entails knowledge of how the child relates to the family and how the family reacts to the child. To thoroughly investigate these aspects, one needs to develop good interview techniques and obtain a reliable report of what occurs in the home. Only one person should visit the home. To have the entire evaluation team visit the home is difficult, expensive, and has other disadvantages.

Children born with serious sensory deficits are automatically shut out from the normal acquisition of social orientation, perhaps even from intrauterine stimulation before birth. This contributes largely to what observers refer to as "autism" in our population. These children find it difficult to tolerate interference in their very silent and very dark universe, and thus they tend to shut out attempts to increase perception and acuity. This must be dealt with if we are to get anywhere with these children. Entire bodies of knowledge and techniques of treatment have emerged within the last decade, all in an effort to enter the children's worlds so as to teach them, and all basically lumped under the term "behavioral modification." As with all other disciplinary concepts, consistency and cooperation are the keys.

As anxiety is reduced in children and families, to a relative degree learning is increased; one success builds upon another. In this respect even minute successes must be quickly exploited and interpreted to parents and other personnel working toward the benefit of the child. Toward this end the developmental evaluation or assessment is a dynamic and ongoing process; ideally, there should be a developmental expert (no matter what his or her professional title) in every educational/rehabilitation setting that deals with the maturation of this population. One then can make orderly, objective, and consistent observations of the growth and progress of the children, plus be in a better position to document this for reporting to parents and to funding institutions in order to ensure continuation of the program for the children. Psychiatric problems within members of the family are greatly reduced as their anxiety around the handicapped child is reduced and the "weak link" becomes stronger. I have seen dramatic changes in interpersonal relations occur, for example, when a child can come to the dinner table and eat with the family or go to a public restaurant with the family for the first time. Self-care activities of daily living are extraordinarily important and are perhaps the easiest to examine and document. This is also an area which coordinates beautifully with all the other cognitive areas mentioned, cutting across parameters of language, motor, and conceptual modalities. Self-care has its practical aspects and is of the utmost importance to families; it is also a fertile ground wherein to train for all skills, particularly communication. When a child becomes toilet-trained, for example, a complex mental continuum has been transversed successfully and a certain level of maturation and cognition can be assumed; however, an objective examiner must determine the level of success. A parent or teacher may be too subjective to be accurate for documentary purposes.

In closing, I have attempted to outline rationale and procedures for assessment of the multihandicapped population. The key to meaningful assessment is that it has a real purpose and is only the beginning of a long road to total communication about the child. In this way each child has his own standardization group. No attempt is made to document IQ or grade level with tools that are designed for an intact population. Assessment will be successful only to the degree that treatment, rehabilitation, and evaluation are consistent.

Role of Sensorimotor Experience and Perception in the Acquisition of Language

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I would like to discuss the acquisition of a language system, oral or manual, as based upon the child's ability to "order" or organize the sensory information he or she receives for association of that information or experience for meaning.

During the time I have worked with deaf-blind children, I have become aware that our major task as educators is not only to facilitate the sensory input on its way through the barriers of the sensory receptors (end-organs: eye, ear, and so forth), but also to concentrate our efforts on helping the child organize that input. Without integration and organization of experience, there is not a sufficient basis for language. In other words, the child has no representations or images from the experience with which to connect a language label.

The word *perception* is an abstraction used to help us imagine how organisms receive, organize, and utilize information received through their sense modalities. The object of sensorimotor and perceptual training is not to make the eyes and ears see and hear better, but rather to help perceivers maximize the use of their sensory modalities and to organize the information or input received from same. After children have participated in structured perceptual training that is relevant to their needs, they may appear to see and hear better. Actually, the children have improved their attention span and their ability to integrate sensory input into usable information.

Process of Perception

Perception is a complex process. Energy impinges on the sensory end-organ. Then, this energy travels along the nerve pathways that lead to those special reception areas of the brain for particular sensory information. One can imagine that the sensory energy is "deposited" in the reception area of the brain. The sensory input then "fits into" neural patterns in the association areas of the brain. At this point the sensory input is coded and processed and is available for association with past or present experience for meaning. In the integrative phase the brain is dealing with all of the sensory input from the experience or activity.

Many sensory impressions are received at one time. For example, the children may be engaged in a discrimination task which requires that they group all "round things" into one set and all "square things" into another set. During this activity the children are not receiving and integrating only sensory input in regard to shape and form (visual, tactile, and kinesthetic such as tracing contours of shapes or stereognostic such as experiencing the three-dimensional nature of shape). The children are also receiving sensory input about the position of their bodies in space, the relationship of the figure stimuli to the background stimuli, the feel of their clothes, whether or not they have to go to the bathroom, the light coming through the window, the fire engine squealing by the school, and so forth. With deaf-blind children these "other sensory impressions" may be more accessible and may be processed more effectively than the figure stimuli to which we are asking them to attend.

Consequently, it is important for us not only to analyze what the figure stimuli are in the task, but also to remain cognizant of the multitude of other stimuli occurring at the same time (within and outside of the body); these stimuli will influence the individual's integration and perception of the figure stimuli, the experience, and/or activity. Part of the perceptual process involves sorting of the sensory impressions into a whole, discounting the extraneous sensory impressions, and organizing the relevant impressions into an image to form a total sensory impression.

At this point in the perceptual process, we hope the children have the total sensory impression. If they do, their task then is to deal with that impression in regard to past and present experiences. Our perception is so influenced by our "histories" or our past experiences. After all this, a motor or muscle response occurs. It can be overt or covert. Simultaneously with this response there is feedback into the brain about the accuracy or inaccuracy of the perception. In other words, does the perception fit what the perceiver thinks it should? Is it congruent with the external reality? This feedback to the brain about the individual's response provides a "monitoring system" for the perceiver. This monitoring system or feedback chain has been postulated to be a significant variable in sophisticated problem solving.

Perceptual Development

We teachers rely upon the motor response of the child to notify us of the child's "understanding" of an activity or experience. Usually, we teach the child a specific motor response or a series of motor responses to encode as a result of his or her sensory impressions during particular activities. Prior to programming a motor response to a certain experience, we would be well advised to allow the child ample opportunity to respond to the experience with his or her very own motor response. In this way I think we can gain information about the way the child is organizing his or her experience. We need to remember that children have their own "histories" and that as you and I do not perceive the same event similarly, neither does the child, especially the sensorially impaired child, perceive the event as an adult. Consequently, the motor response we are programming may not be logically tied to or coordinated with the child's perception of the event. Some basic principles about perceptual development are sequential and need to be kept in mind as we keep in mind, for example, the sequence of motor development.

Perception develops from global to specific. For example, as the child matures, he or she tends to differentiate stimuli within the environment. At one month of age and under, the sighted and hearing child has begun to perceive color and general form. Whether the deaf-blind child is chronologically or functionally one month of age, we would be well advised to capitalize on this developmental capacity, because it provides a beginning foundation for further perceptual development and interaction with sensorimotor experience. At this developmental level we can substitute the infant's sensitivity to color patterns and forms for the deaf-blind child as follows: (1) use color patterns with the textures, with strong contrasts in the textures; and (2) communicate form and shape through helping the child to manipulate the object thoroughly, being sensitive to the manner in which the child investigates the object.

When a blind child is exploring an object such as a ball by rotating it across his or her face, should the teacher interrupt and force the child to use a type of activity a sighted child would use? The sighted child has the constancy of his or her visual impressions to maintain contact with the object as the child rotates the object and explores it during his or her manipulation. The deaf-blind child may have only his or her body contact with the object as a constant. Therefore, it appears that maximal body contact would facilitate a total sensory impression of the form and shape of the object. Later, we can work toward "less close body contact" with the object. At a more mature state of development, this would be appropriate just as it is with the sighted child who begins to recognize a table simply by seeing the leg of the table. Many steps are involved in the perceptual process between these two types of recognition.

Perceptual Training

Sensory stimuli become more distinctive when specific language labels are given. The implications for this principle of perception and its association with language are great. When an object or event has been encountered repeatedly, it should be labeled for the child with simple oral and manual language labels. The teacher should watch for the child's anticipatory response to the activity and capitalize on this response and use it initially as the label for the experience. These types of anticipatory responses might be considered the beginning roots of natural or primitive language. These responses have already been associated with the actual event or activity and, as a consequence, have meaning for the child. They can serve as very valuable beginning gestural systems for the child. Also, in using these types of anticipatory responses and capitalizing upon them, the teacher communicates to the child a sense of dignity and a sense of positive regard that is so essential to the child's self-concept. Can you imagine the frustration of the child tugging on his or her pants to communicate a need to go to the bathroom while that gesture is discounted by the adult who superimposes over it the sophisticated sign for restroom. There is plenty of time to refine the language process. The normal child takes three to four years to do this. Why do we expect the deaf-blind child to proceed to this language-refining level within six months to a year?

The perceptual process depends upon age. The child of three and under will more than likely react to the whole rather than the specific parts of the material or the event. As the child gets older, he or she will be able to identify the parts making up the whole.

The child who is developmentally and/or functionally three and under should be provided with materials and experiences that have one quality information at a time. For example, rather than providing a sensorimotor exercise of form discrimination which uses cubes and spheres (balls) that have various textures, it might be better developmentally to use cubes and spheres that have the same texture. Thus, the maximum contrast will be with the form which is the discrimination task (at least at a sensorimotor level) that we are trying to communicate to the child. As the child matures, we could sequentially add more detail and discrimination data for the child to organize and add to his or her perceptual and conceptual "filing system" for recognition of objects.

Another aspect of perception that is age-dependent is the child's attention to, or appreciation of, the direction and position the object holds in space. This has to do with aspects of the object's sides, its top and bottom, and its position as close to the body or away from the body. At about five years of age, the child begins to associate his or her own body's sidedness with the terms right and left. Only after that can the child be asked to project his or her body's sidedness onto an external object and determine the object's sidedness with the terms right and left. At about seven years of age, the child begins to determine the right and left sides of the person or the object facing him or her. The implications for the development of this aspect of perception with the deaf-blind child might be as follows:

1. When presenting materials, sit next to the child, preferably at his or her dominant side. In this way the child is not called upon to work in opposition to his or her own body's laterality. From this position we can work as movement and exploratory motion facilitators, rather than as pushers or pullers, forcing the child to reverse his or her laterality before he or she is ready.
2. Engage the child in a variety of "body image" exercises that give him or her ample experience with his or her own body's laterality prior to asking him or her to project this onto objects. For the visually impaired child these types of exercises are especially significant because so much direction and position in space data are visually determined. We must design exercises from which the child can get tactile and kinesthetic feedback about the parameters of his or her body, about the space in which his or her body exists, and about the objects within the space. The refined sense of perception of direction and position in space significantly affects the child's ability to handle reading symbols, whether they are printed symbols or the tactile symbols of braille. Each letter has a top and bottom and a right and left side. Also, it has a specific position within a word.

Jean Ayres (1973) explores the following two hypotheses:

1. Perception in the various sensory modalities develops interdependently as maturation in one is dependent upon maturation in the other.
2. A hierarchical sequence of development of the sensory systems exists, and each step in the sequence is somewhat dependent upon maturation of the previous steps.

Sensory System Development

The hierarchical nature of sensory system development and perception has particular significance for me in understanding the deaf-blind child. Dr. Ayres suggests that the maturation of the vestibular and tactile sensory systems significantly affects the maturation of the developing auditory and visual sensory systems. The "ladder of sensory system development" might be as follows:

1. Olfactory: sense of smell; and gustatory: sense of taste
2. Vestibular: sense of body's reaction to gravitational force, sense of body's position in space, posture, and movement direction

   Kinesthetic: sense of movement or movement memory
   Proprioception: feedback from body's position or movement
   Stereognosis: sense of form/shape–three-dimensional
   Spitz (1945) combined steps 1 and 2, calling them "coenesthetic," and distinguished this experience from the more discriminatory visual and auditory experiences.

3. Tactile: sense of touch
4. Visual: sense of "sight" (Developmentally, visual information apparently is used cognitively before auditory.)
5. Auditory: sense of "hearing"

The role of the baric and thermic sensory systems has not been responded to specifically. I would imagine they would be closely associated with the vestibular system weight being relative to the earth's gravitational force and temperature being experienced through touch or external contact with the skin.

From these hypotheses and from Dr. Ayres' comments, we might expect that structured and meaningful stimulation of the vestibular and tactile sensory systems might facilitate the child making use of auditory and visual input and increase his or her ability to organize that same input in a manner that would have greater likelihood for meaning and consequent association. This would suggest that we would be developmentally more sound and be making a better use of the child's energy as well as our own energy by moving to a "lower level of sensory system and perceptual functioning." In addition, Dr. Ayres postulates the role of the vestibular system as being a "unifier for all other sensory input coming into the child." Since all other sensory information is received on the background of the child's body in space or his or her posture, the role of the vestibular system is purported to be major.

Caviness and Gibson (1962) have indicated that perceptual discrimination is facilitated only when there is motor mediation. This point of view suggests that we could ask the child to look at a form of a circle and a square, but, without his or her tracing and exploring the contour of the forms, his or her discrimination of the two forms would not be significantly improved.

The implications of the hierarchical sensory system development (Ayres, 1973) and this "coenesthetic" experience (Spitz, 1945) have great significance for those who work with the deaf-blind child. Early in the child's life the opportunities to receive sensory input from the vestibular, kinesthetic, and tactile sensory systems have been modified significantly. They have been modified often by the child remaining in his or her crib or bed for large portions of his or her early life. They have been modified by the child's initial difficulty in being held, fed, cuddled, and fondled. They have been modified by the lack of options the child has for body positions (supine, prone, and so forth). Apparently, moving to a lower or more basic sensory integrative level with the deaf-blind child is as logical as working on, for example, protective responses with the child in a sitting position before we ask him or her to pull to stand. Hopefully, with this type of approach, we are helping the child to lay strong and sound foundations for future growth and development rather than encouraging a multitude of splinter skills to develop. Splinter skills do not provide good springboards from which further sequential development takes place.

Sensorimotor Experience

The major part of primary learning presumably is based upon the child's early perceptual experiences. The basis for primary learning is chiefly on the sensorimotor side, and the intrinsic regions of the brain must be programmed properly by this preverbal experience if the human organism is to later function effectively as a problem solver.

We need to provide many opportunities for the child to gain experience that is sensorimotor in nature, so that he or she may "program" the regions of the brain for organizing sensory input, integrating that input, and associating it for meaning. As mentioned earlier, without this early preverbal experience, no basis exists for a language system. The child's chronological age may camouflage his or her need for these earlier sensorimotor and preverbal perceptual experiences.

The process of acquiring a language system requires the person not only to be able to receive the sensory input, but also to retain that sensory input in its particular sequence, order, and pattern. When the sequence of the sensory input is changed, the meaning is also changed. This is especially true with sensory input in regard to language, whether the sensory modality being stimulated is auditory, visual, or tactile.

It would be interesting to analyze the tasks we are presenting to the deaf-blind child in regard to not only the sensory modalities stimulated, but also as to what perceptual skills are called upon by the task at hand and to apply this understanding to the point where the child may be having problems. At which perceptual level does the child need help? This information would be extremely important in our constructing programs for the child, as are all the observations of the child and his or her unique system. Perhaps the point I am making here is that it is only with careful observation of the child (taking our clues from the child, surveying his or her behavior as to how it might seem adaptive to him or her at a certain time in space, and allowing the child to show us who he or she is) that we program appropriately. This point of view does not offer a curriculum, but rather it offers an approach to designing a curriculum and a program for the child.

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Significance of Motor Development in the Deaf-Blind Child

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The education of the deaf-blind child presents an enormous challenge. If we as educators are to follow the philosophy of educating the total child, then it is difficult to ignore the aspect of physical and motor development. We often overlook what is important, meaningful, or realistic in our educational provisions. Although communication and cognitive development deserve priorities, the physical and motor aspects also must be considered, not only in terms of providing a sound structure to house cognitive and communication skills, but as an adjunctive mode for learning. In this paper I will discuss motor development with regard to its function in the education of the deaf-blind child, emphasizing the precursory and adjunctive roles. Emphasis will be placed on assessment procedures, programming, and teaching motor skills to the deaf-blind.

Meaning of Movement

To the young child movement means many things. Whitehurst (1971) refers to movement as a means by which the child discovers his or her world. The infant moves his or her head to focus his or her eyes in relationship to a sound and finds objects to explore. As a toddler, the world is extended by the child's own mobility. The child now can go to new objects which do not come to him or her, and examine and explore them. By moving to near and far points, new concepts regarding spatial awareness are formed. Movement can be used to establish contact and communication. But more important, movement is self-discovery which emerges early from hand regard in the infant, to movement exploration when the child climbs, runs, jumps, feels, and experiences what his or her body can do. As the child moves, he or she discovers himself or herself as a separate entity, able to distinguish between what is part of himself or herself and what is not. During the first years of life, action is dominant for the child.

Lichtenberg and Norton (1970) emphasize that interaction with the environment produces motor schemata that alter the way the child perceives and responds to the environment. Without interaction, schemata do not grow; and without schemata, the environment cannot be structured. Schemata develop in order, and the order stems from the child's experience with objects and his or her world, not simply from maturation. Ismail and Gruber (1967) emphasize similar thoughts by explaining that movement and motor development serve as the foundation for developing systems needed for handling information in an organized fashion.

Perceptual motor schemata result from systematic motor exploration and the use of this exploration to systematize perceptual data. When these initial schemata have been developed, they can be used to develop more complex operations without the need for additional motor intervention. Movement for the sake of movement is a necessary part of growth and development. From this aspect, movement serves as a foundation upon which to build more complex structures. It also provides tools for handling early sensory perceptual information. In this sense, motor development fulfills its precursory role as it serves the readiness for the child to learn; however, motor developmental activities may be used as an adjunctive modality for learning when cognitive skills are linked with motor training. The adjunctive role that movement plays in achieving other objectives is based on the premise that the learning of motor skills provides a favorable and stimulating environment in which the child can acquire cognitive skills when they are integrated with motor tasks. Much of the motor development of early infancy and childhood is regarded as frivolous play or exploration because it does not produce a material product. The motor exploration of the infant and child is very serious business, as it produces internal development of sensory perceptual motor abilities that aid in the foundation of intellectual performance (Bowers, 1972).

Movement and motor development can have the same meaning for the deaf-blind child; however, it does not evolve spontaneously as in the normal child. Our task is to structure learning avenues that integrate, interpret, and develop motor processes as they unfold in the normal child.

Normal Motor Developmental Processes

Arnheim and others (1969) define motor development as the process of growth and maturation by which an individual attains control, first over his or her own body, and then utilizes that control to adapt to the environment. This does not imply that the two processes are entirely separate; however, they may occur in conjunction with one another. Maturational readiness and experience play a significant role in the acquisition of motor skills. Despite the complexity and variability in motor skill development, it may be systematically approached and organized to understand the developmental processes. Organization does not occur in precise or distinct steps; however, Bowers describes the organization as a gradual reduction in certain movement behaviors and the gradual appearance of more advanced actions. Lower-level movements precede and are integrated into more complex higher-level movements. Considerable overlapping occurs between various levels of development. For instance, a child just taking his or her first steps may still resort to crawling as a preferred method of locomotion. Thus, earlier patterns do not have to be completed abruptly before later patterns appear.

Breckenridge and Murphy (1964) explain that motor development proceeds in a cephalocaudal direction in which simple movements of the neck and trunk appear to be more highly developed first and are followed by the gross, simultaneous movements of the upper rather than lower extremities. This development takes place in the direction of the proximal to distal portion of the limbs. This growth pattern results in the large muscles, which produce gross movements, being more highly developed at an earlier age than the smaller muscles, which produce finer and more precise movements. Motor developmental processes can be viewed as the gross maximal involvement of musculature to minimal, more refined involvement. As movement becomes internalized, more complex movements can evolve to coordinate and integrate movements of the upper and lower extremities.

Developmental Sequences

During the first month of life, the infant's movements are primarily reflexive. As the child develops from his or her reflexive state through integration of involuntary movements into undifferentiated patterns, more refined movements are organized from simple to complex. This pattern allows the individual to develop adaptation in conjunction with his or her developmental and experiential levels. During the first four months, the infant is primarily apedal until head, neck, and trunk control are established. Around four to six months of age, the normal infant will begin to move by crawling (with stomach in contact with the floor) and then creeping on all fours with increasing accuracy and coordination, evidencing a cross-extension pattern. The infant may also propel himself or herself backward and forward while in a seated position.

Assisted walking may be observed by ten to twelve months of age, and by fourteen to sixteen months of age most normal children will usually walk unaided. During the child's first attempts at walking, a wide base of support is employed with the feet turned outward. By eighteen to twenty-four months of age, more efficient walking with a narrow base and rhythmical gait is employed. Until the initial stages of walking are internalized, the child may watch his or her feet and not until later will the child shift his or her gaze from the feet to sought-after goals. Maturational readiness must be considered when teaching the child to walk. Forcing a child to maintain an upright position prior to the development of reasonable muscle tone in his or her antigravity muscles (extensor muscles in the lower back, extensors of the legs, muscles to the rear of the neck, and so forth) is not realistic and could lead to postural problems.

As rhythmic regularity is developing in the walking gait, the child will attempt to vary his or her movement patterns. Rudimentary running will often be observed in the latter part of the second year, consisting of a fast walk with one foot remaining in contact with the ground. Now the child is completely bipedal in locomotion. During the second year the child can be observed to evidence a true run with both feet out of contact with the supporting surface.

By three years of age, the child will begin jumping skills with one leg preceding the other when jumping forward or from low heights. Near the end of the third year, jumping becomes more coordinated and two-leg take-off and landing are employed.

By four years of age, the normal child will be able to run and walk well, evidencing good coordination between the arms and legs. Near the end of the fourth year and by the fifth or sixth year, the child will make more complex adaptations with his or her motor skills. By the age of five or six, most of the basic motor skills have been developed (Cratty, 1971).

Manipulative Skills

Vision plays a significant role in the development of manipulative skills. In the normal child manipulative behavior is instigated by the sight of an object.

At birth and during the first two or three months, the normal child will reflexively watch moving objects for brief periods of time. During this time the child will begin tracking objects as they move through his or her visual field.

Around three to five months of age, the child will attempt to make swiping movements with his or her hands to obtain an object, or a crude corralling motion may be observed with flexed motions of the arms. When objects are placed in the child's hands, he or she will reflexively hold them.

During the next few months, as the child begins to hold objects for increasing periods of time, he or she may begin to seek objects and contact them with his or her hands. Movements may be somewhat uncoordinated. At about nine to eleven months of life, the child will begin to control his or her arm and hand movements so that the child can successfully bring his or her hand in contact with an object in more precise form. Grasping may be less crude, and the fingers may be used to manipulate objects.

By twelve to fourteen months of age, the child will begin to develop greater skill in manipulating objects. For example, the child may stack objects, hit them together, and fling them accidentally as he or she makes random shaking and swinging motions with his or her arms. At this time the child is learning to use his or her motor skills in manipulating objects.

Around eighteen months of age, the child will attempt scribbling, which becomes increasingly accurate as the child matures.

As the child grows older, finger dexterity, involving the manipulating of objects with the fingers, will improve. Manual dexterity (rapid use of the hands and wrists) and steadiness increase to allow greater precision in manipulative skills.

Motor Problems of the Deaf-Blind Child

Sensory-impaired children may not naturally progress through the various stages of growth and development, reaching plateaus at normal chronological ages (Hatlan, 1971). Although many sensory-impaired children may go from sitting to standing to walking, without creeping, this does not necessarily mean the child will not learn to walk; however, the early exposure to cross-pattern integration of the limbs may be omitted. Such children may evidence problems when performing tasks requiring coordination of the upper and lower extremities. Fraiberg (1969) emphasizes that the absence of vision greatly reduces the organization of motor responses at the midline. Without sufficient stimulation and proper training in the early stages of development, the child's hands may not engage at the midline at all. The coordination of this schema may be considerably delayed until the tenth or eleventh month, whereas, in the normal child, such schemata may occur at five months. DuBose (1974) explains that the blind infant fails to learn to track objects; consequently, muscular development and eye-hand coordination are delayed or they fail to develop. The delaying effects of sensory impairments in the development of gross and fine motor skills may be apparent before the fourth month. DuBose further emphasizes that, as the sensory-impaired child matures, he or she fails to generalize learned motor schemata to other objects. Delays in walking and other locomotor skills will affect spatial awareness, exploratory behavior, and experimentation.

Children who have more than one sensory impairment will generally have more motor problems and delays in development. Hatlan (1971) indicates that evaluations conducted in diagnostic centers with deaf-blind rubella syndrome children found these children to be functioning motorically at two-and-one-half years below their chronological age. In many rubella syndrome children, development is arrested at some point in the sensorimotor period. In a recent investigation by Folio (1974), 48 deaf-blind children were evaluated with regard to gross and fine motor skills. Findings indicated that motor skill levels were approximately at half the child's chronological age. Fine and gross motor skills tended to parallel each other in development with fine motor skills slightly below gross motor skills except in children ranging in age from seven to eight years. At these ages fine motor skills were slightly higher than gross motor skills. The children within these age ranges were in classrooms and participating in programs where little emphasis was placed on gross motor training.

Van Dijk (1965) explains that the deaf-blind child will develop several basic motor patterns; however, the child's motor actions do not serve to make adaptation to the environment. Actions are intended to stimulate the child's own sensory gratifications. Movements are displayed in the form of stereotyped behaviors consisting of light and object flicking, rocking, or body rubbing. Consequently, few appropriate motor actions are employed for gathering or interpreting information. Programs initiated by Van Dijk emphasize motor development as the central portion of the totality of education. For the deaf-blind child, interaction and communication with his or her world are developed in a moving-acting relationship with others. Motor development in this sense is more than simple movement; it becomes the center of the child's closed world, which must open to him or her from a growing and developing body. The child becomes aware of his or her body, its parts, its movements, and uses these skills first to make adaptations on command and later at will.

Early identification of the deaf-blind child is a must so that he or she can be brought through the normal motor patterns of development. When left to his or her own amusement, the deaf-blind child will simply engage in motor mannerisms, remaining in his or her closed world. If one understands how multisensory impairments affect the precursory and adjunctive roles of motor development, a more distinct understanding of the unique motor problems of the deaf-blind child may be evidenced.

Developmental Assessment and Programming

Recognizing the cumulative nature of the growth and learning processes and the effects an earlier deficit will have at subsequent levels of development, a developmental approach to motor assessment and programming seems to be the most logical model. Such a model allows observation of motor behaviors that are measurable and indicative of a specific level. From these common sequences, descriptions may be made and each child compared to what normally occurs in children who are not handicapped. An attempt to develop a model based on a deaf-blind population would present an unmanageable task due to the diversity of this group. Information can be gathered on such children, and it will aid in determining each child's skill level, pinpointing gaps in development, and establishing appropriate target objectives. Such information supplies a basis for developing a sequential intervention program and criteria for evaluating its effectiveness.

Comprehensive Assessment

Comprehensive motor evaluations will provide important information about the child's abilities in motor skills. Significant factors regarding this process are the following:

1. The child's functioning level must be determined.
2. One must not only be concerned about whether the child does or does not perform the skill, but more important, one must consider the quality of performance. For example, the four-year-old child may walk, but the quality may be like that of an eighteen-month-old child.
3. Gaps in the developmental sequence must be noted. By knowing the normal sequences, the effects the gaps will have on present levels of functioning and the development of higher skills may be determined.
4. Acquisition of prerequisite skills must be recorded so that the readiness to acquire more complex skills may be determined.
5. As a result of these assessment processes, a developmental program can be sequentially arranged to meet the individual needs of the child.

The evaluation of a child is only as complete as the assessment procedures that are used and only as valuable as the programs developed through the interpretation of results. If the preceding motor evaluation processes are to be followed, an assessment instrument is needed. This instrument will allow this kind of procedure, and just as important, it will provide activities from which to program.

Assessment Instruments

Several attempts have been made to design developmental scales; however, few existing assessment instruments provide the comprehensive motor evaluations required for effective educational management of the deaf-blind child. Several reasons appear to be significant. Generally, the age span covered is too narrow, or, if a wider age range is included, the skills tapped are too limited and contain only developmental milestones. Performance is usually judged on a pass-fail basis, indicating limited knowledge about where in the learning process the child may be. An all-or-nothing approach provides little information for potential skill acquisition. Evaluators have found few, if any, adequate developmental activities that will provide precise programming in terms of evaluation results.

Hayes (1974) emphasizes that most motor programs for the deaf-blind are unsuccessful because they fail to set appropriate expectations for function by the child or there is inconsistency in the implementation of the intervention program. In view of the problems with ineffective programs and existing assessment instruments, a developmental guideline and programmed activities for motor skills have been constructed by Folio and DuBose (1974). These would allow for the previously cited evaluation and programming processes.

Developmental Motor Scales

The *Peabody Developmental Scales* were devised as a guideline composed of gross and fine motor abilities that normally occur in infants and children through six years of age. Developmental activities are included for each skill tapped so that those individuals working with the child may plan and implement a sequential program to fill in existing gaps, improve present status, and arrange for the acquisition of higher-level skill. Motor assessment should not occur in strict isolation, but in relation to the child's adaptive capacity. For example, to say that a child has a mature grasp is not sufficient information. One must know if the child utilizes his or her grasp effectively and efficiently to adapt to the demands of his or her environment. Thus, selected items are those which would stimulate the child to use his motor capacities to adapt to specific situations. More items are included at each level so the child will have a greater opportunity to demonstrate his or her abilities, without being limited by one or two discriminating skills.

Rating Performance

Five criteria are provided for judging performance on each skill, ranging from total dependence to complete independence in performing the task.

Programming

When the motor abilities of the child have been determined, the evaluator can then use the activities provided to select appropriate learning sequences.

Scales and programs of this nature have several implications for educators. They may be used in classrooms by teachers and in the home by parents. Home training programs will have common guidelines for early interventions, thus targeting training at an early level before developmental delays become even more delayed.

Implications for Programming

Individually prescribed instruction is the key for effective motor programming with the deaf-blind. Because each individual has specific needs, no one program can be recommended here. A diagnostic/prescriptive approach will allow specific objectives to be determined for each individual. Setting sequentially arranged learning experiences will allow change in behavior without the frustration of failure.

Integrated concept. Motor training must take the form of totally integrating the whole child into the learning experience. Training an arm or a leg in a skill is of little value unless that skill can be integrated into meaningful action for the child. Many unsuccessful programs have operated on the segregated concept. The human organism is much too complex to segment for educational purposes. Programs must follow an integrated approach so that learning occurs in the psychomotor, cognitive, and affective domains simultaneously. All disciplines must strive to make a harmonious contribution to the total development of the child.

Major goals. The deaf-blind child must be brought to the sensory stimuli which do not come to him or her via the normal channels. Nowhere does Getman's phrase, "the child must learn to move before he moves to learn," become so important. One paradigm suggested for development of perceptual motor functioning in the deaf-blind individual begins first with training general movement patterns and then with specific skills which integrate with sensory modalities. Programming may include the following sequential stages: motor to sensory to sensory-motor; motor to perceptual to perceptual-motor; and perceptual-motor to cognitive.

Areas of Motor Programming

A solid motor base must be established in four areas following a developmental model. Many specific skills taught may be categorized into one of the four areas (Kephart, 1971).

Posture and balance. Posture and balance are important because they are basic to and underlie the performance of motor skills. They require even more refinement when motor skills are adapted to specific situations. Orientation of the body by balancing creates a constant perspective from which stable spatial relationships and perceptual judgments are formed.

Locomotion. When proper posture and balance are maintained, adequate locomotion can be developed. Locomotor skill is important to the deaf-blind child because it increases mobility and independence.

Receipt and propulsion. Receipt and propulsion activities involve receipt of objects moving toward the child and propulsion of objects away from himself or herself. Concepts about size and distance may be formed, further increasing spatial awareness.

Contact and manipulation. Deficits in manipulative skill prohibit the child's becoming aware of textures, shapes, and objects. By developing acuity in manipulative skills, information gathering processes may be increased.

Movement Coordination

In conjunction with establishing a sound motor structure, integration of basic movement patterns and skills with sensory modalities must occur. All available use of residual sensory modalities must be organized and coordinated in a meaningful and purposeful manner.

Visual-motor coordination. Programming should include the pairing of correct motor responses with incoming visual cues. Each child must be taught to interpret near and distant visual stimuli. A variety of tracking and accommodation exercises must be paired with the activities.

Auditory-motor coordination. Sound cues should elicit proper motor responses. Additionally, directional patterns should be integrated with auditory input. In other words, the child should be able to localize sound. Such integration will eventually lead to following directions via auditory channels when this is possible.

Gustatory-motor coordination. Integration of awareness of taste paired with the use of tongue and jaw movements will aid in developing eating skills.

Kinesthetic-motor coordination. Kinesthesis can be defined simply as the feeling and interpretation of movement. Development of a kinesthetic figure-ground is a necessity so the child can recognize the proper and necessary movements required of specific skills.

Tactile-motor coordination. Tactile discrimination through manipulative skills must be developed to ensure identification of objects, size, texture, and shape.

Sensorimotor Integration

Various sensorimotor integrations must be developed. The motor program should include the following:

Body awareness. Enhancing body awareness will aid in the ability to recognize body parts and their movement capabilities. Achievement of awareness of self and awareness of surroundings is a critical goal in programming.

Rhythm. Rhythm is referred to in a rather global sense and includes the harmony and efficiency of movement.

Flexibility. Flexibility refers to the modification and shifting of movement patterns to meet situational demands.

Directionality. Directionality refers to the ability to match visual information concerning external objects with the previously established kinesthetic awareness of direction within the body (Hayes, 1974). Internalization of directional change must occur before the localization or movement of an external object in space can be determined.

Laterality. Laterality refers to the internal awareness of both sides of the body. Its importance cannot be overemphasized in coordinating one side of the body with the other.

Motor planning. Motor planning refers to the planning of movement prior to its execution. Ability in this area will develop independence and decision making on the part of the child. Movement exploration has a great potential for developing such skill in the deaf-blind. Motor planning enables the child to appreciate his or her movement capabilities, to experiment, and to explore a variety of movements in relation to space.

Although the preceding program guidelines are concerned primarily with developing the precursory role of motor skills, the following section will emphasize development of the adjunctive role. This aspect of programming is mainly concerned with the incorporation of cognitive skills with motor activities and the development of impulse control.

Many deaf-blind children demonstrate, at times, the inability to focus their attention on tasks for more than a few moments. Such distractibility interferes with the teaching-learning process. Cratty (1971) emphasizes the use of gross motor activities to develop impulse control. A three-step approach is suggested as follows:

1. The beginning phase involves relaxation training. Primary objectives are to get the child to reduce muscular tension and impulsivity. Training may involve activities that allow the child to make pendular movements with the arms and trunk.
2. The child, as suggested by Cratty (1971), should be required to perform motor tasks as slowly as possible. Movement may consist of walking, rolling, or creeping as slowly as possible.
3. The child should be helped to produce more precise actions and maintain them for longer periods. Training activities may include imitation of movements such as bringing the arms overhead slowly and holding the position for increased periods. Training for impulsivity will aid in placing the child more in control of

himself or herself and develop a set for more complex learning.

Academic Operations

A program of motor activities can serve as a learning modality for cognitive skills. Such programs have proved highly successful with impaired and nonimpaired children. Many of the activities may be adapted to the deaf-blind child, and cognitive skills commensurate with the child's level may be integrated with gross motor skills. While it is true that throwing a bean bag at a target will develop eye-hand coordination and throwing accuracy, a slight modification in the task will result in an improvement in cognitive skill. If the targets, for example, are designed with corresponding bean bags so they represent various shapes, the child may be required to toss the square bean bag to the square target and so forth. As a result, ability to discriminate between shapes may be improved. The possibilities for such activities are unlimited. Cratty (1971) presents over 100 active learning games for enhancing academic functions. Many of the games may be adapted for deaf-blind children.

Language and communication have been developed through motor activities with sensory-impaired children. Generally, deaf-blind children are willing to learn gestures or some form of communication skills for things that are really stimulating to them. As a result, many of the first learned signs begin with eating skills. Motor activities supply a stimulating situation for incorporating communication and language development, as motor activities naturally interest the child and hold his or her attention.

Communication Training

Stephen is a five-year-old boy who has minimal vision with some light perception. At the beginning of his program, he was able to discriminate large objects but not identify them except through tactile information. His light perception and ability to locate large objects were evidenced by his mobility, as he was able to move about, only occasionally tripping over objects on the floor. Some receptive language was observed as he would follow simple commands when attending. He recognized his name and those of others in the family. Expressive verbal skills were extremely inappropriate, although he would speak in sentences and repeat verses of simple songs. Many of his responses represented echolalia as his verbal expressions fitted into no contextual sequence, even when by himself or with others.

Communication and language training were incorporated into a prescribed structured motor program. His first attempts at appropriate communication were evidenced after several shaping sessions requiring him to hit the bed of a trampoline when he wanted to jump. Gradually, consistent responses emerged. At this point the word "jump" was paired with the action of hitting the trampoline and jumping. Emission of the word "jump" was required before Stephen was allowed to jump. As progress continued, identification of the trampoline was required in addition to emission of the word "jump" before jumping. Similar procedures were used with other motor activities and later with classroom activities. Occasionally echolalic speech was emitted; however, after four months, Stephen was speaking appropriately and engaging in conversation actively to make his wants known.

Further exploration of these procedures is needed; however, the implications drawn from these few examples can be instrumental in developing motor curriculums for the deaf-blind child.

Teaching Strategies

The following teaching techniques may be used when facilitating motor functioning with the deaf-blind child.

1. All safety precautions should be taken to ensure freedom of movement. This necessitates the child becoming totally familiar with the space where training will occur. When an apparatus is used, try to locate it in the same place so greater mobility will be facilitated.
2. Physical guidance of body parts is essential in the initial stages of acquisition of new skills. Through manipulation of body parts the child can gain a "feeling" for correct movement sequences. Faulty movement patterns may also be corrected through this method. Working from behind the child is a must when applying manual guidance so the child can perceive the movements more accurately.
3. The tasks should be sequenced into small steps, and skills should be improved.
4. The child should imitate the demonstration. Those with limited vision may feel the demonstrator's body movements to understand what is required.
5. The deaf-blind child needs his or her movements associated with a goal so they will have more meaning.
6. Overlearning is essential for retention of newly acquired skills. When initial learning

has been demonstrated, repetition of the skill is necessary so that overlearning occurs.

7. Short practice sessions, interspersed with frequent rest periods, seem to be the most efficient and effective methods for teaching skills.
8. When a child first learns a skill, movement will not be well coordinated; consequently, movements should not be hurried so that correct form can be established.
9. Equipment should be adapted to coincide with the child's abilities. When catching skills are being developed, for example, a large, slow-moving ball should be used so the child has time to react to the incoming stimulus.

Summary

To ensure adequate motor development in the deaf-blind child, curriculums must be designed so that a constant focus is placed on the development of those tasks that meet the individual needs of the child. Too many programs "gear the child" to the curriculum when, in fact, the curriculum should be "geared to the child." Thus, programming requires a diagnostic/prescriptive approach following a developmental model. Motor development must be taught so that the experiences acquire the same meaning for the deaf-blind child as they do for those children without sensory impairments. A task of this significance requires that an integrated approach be followed in the teaching-learning process.

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Examining the Deaf-Blind Child—A Communication Gap

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The care of the deaf-blind child requires the efforts and concerns of a variety of individuals. Many people contribute their skills and bits of information toward the total evaluation of the deaf-blind child. Teachers often feel that, because they do not wear white coats, their opinions about the child must be withheld. Nothing could be more erroneous. The teacher's opinions, skills, and ideas are important and needed.

I am an optometrist and my interests are in the child's ability to function visually. As an optometrist, I am interested in the "function" of vision. Particularly, I work with lenses and devices that enable the child to make maximum use of his or her residual vision. The data I gather regarding vision must be augmented by information received from the parent, teacher, physician, audiologist, psychologist, and anyone else who works with the child. This is the only way a relevant diagnosis and treatment program for the child's vision problem can be developed.

To facilitate the integration of the low vision service into the home and classroom of the deaf-blind child, the parent and teacher must understand the service being offered and the treatment being prescribed. Likewise, the examiner must take the time to relate his or her diagnostic data to the home and/or classroom setting. A familiarity with the teaching program allows the doctor to develop a treatment program that is pertinent to the child's present environment and level of functioning.

Definition of Blindness

Blindness means different things to different people. The definition for legal blindness is used for administrative purposes. With best conventional lenses, the acuity in the person's better eye is 20/200 or worse. If his or her visual field (side vision) is reduced to less than 20 percent, he or she can qualify for services available to the blind. The problem with this type of definition is its lack of concern for the person. This measurement is rather ambiguous. I can fairly easily make a person with 20/50 acuity legally blind (20/200) in my office. Far too many variables exist in measuring an acuity to use this as an arbitrary measurement for determining the provision of needed services to people. The number 20/200 has very little relationship to how the person uses his or her eyes.

Other people suffer visual problems, but, since their acuity is better than 20/200, they are denied services. The partially sighted (visually handicapped, low vision, partially blind, and so forth) population is caught in between. Their vision is not acute enough to be considered "sighted," and it is not depressed enough to be considered a handicap in need of assistance and services. One must realize that some of these people function at a lower level than do some of the legally blind. Each person reacts differently to his or her vision loss, and our numbers cannot reflect this individual response to a loss of acuity.

The term blindness must be given a functional definition. The definition must include a description of how the person utilizes his or her remaining vision. Does he or she function more as a totally blind person or as a fully sighted person? (Remember, only 10 to 20 percent of the legally blind have no useful residual vision.) The influence of sociological pressures (blind stereotypes), psychological factors (self-concepts), economic factors (acuity requirements for jobs), and physical environments must be considered along with the acuity.

Two children may have the same acuity, go to the same school, come from similar family backgrounds, and yet react quite differently to their vision loss. I know of two children in this exact situation. The female functioned as a totally blind student throughout high school. The male student was an outstanding student in scholastic activities, a champion cross country runner, and a socially prominent individual on campus. Obviously, factors other than acuity are at work here.

This functional approach to blindness allows services to be provided to those who need them and not just those who fall into some specified category. Services to the blind and partially sighted must not be structured to fit a particular syndrome or definition. As professionals serving this population, we need to be flexible.

E. Mehr and A. Freid have given us the following as a guide: "Services should be available to any person who has a vision loss which cannot be corrected sufficiently with conventional lenses to allow the person to function visually at a desired level."*

In working with the deaf-blind, we have to consider the various levels of hearing loss and how the child utilizes residual hearing to communicate with the outside world. Children with specific levels of hearing loss will respond to this loss as individuals. In providing services to these children, one must weigh the individual's response to the disability.

Low Vision Examination

The low vision examination is a time-consuming procedure. When evaluating the ability of a child to function with his or her residual vision, one considers the child's personality, temperament, goals, and other handicaps. The clinician must first learn to be comfortable with the child. He or she must respond to the child as a person and not as a problem. This can be difficult to accomplish with a deaf-blind child who has severe brain damage. The clinician must realize that this one service alone is not going to solve the child's problems. The vision analysis and treatment program is just one small contribution to the total child.

The actual examination will vary tremendously depending on the child's ability to respond and his or her present educational program. The complete examination procedure should be discussed. The emphasis of the examination is on how much vision is left and how it is to be utilized. The goal of the examination is to provide any devices or services that will enable the child to improve his or her use of vision.

A 30- to 40-minute interview is conducted with each patient. This is where the patient expresses his or her own opinions regarding the vision loss and helps the examiner determine needs. Basically, it allows the examiner to obtain an idea of the patient's self-concept and motivations.

With the deaf-blind child, this information must be gathered from the parents and teachers when they are available. The parents can provide information regarding the child's ability to function visually. The teacher can provide answers to the following questions:

1. What objects can the child recognize in his or her environment?
2. Does the child appreciate and use colors?
3. Does the child use his or her vision for reading, writing, and drawing activities?
4. What are the child's communication skills?
5. What characteristics of the child's behavior will influence the examination results?
6. How much does the child depend on vision for mobility?
7. Does the child have a spectacle correction, and is it used?
8. What level of lighting does the child prefer?
9. How much does the child use his or her eyes to explore his or her immediate world?

Once the background information is gathered, the examiner can better evaluate the diagnostic data collected in the remaining examination procedures.

The next procedure is to obtain a visual acuity. While I believe the teacher should ignore the acuity number, it is still an important measurement for the doctor. Many doctors will not take the time to measure the child's acuity correctly and will report an invalid approximation. Sometimes children with 20/400 acuity are reported to have finger count or light perception acuity because the vision was not correctly assessed. If the teacher bases the educational program on the acuity of light perception (totally blind) instead of the 20/400 the child has (large print), that little number or acuity designation will have a drastic effect on that child's life. He or she will be brought up to function as a blind person instead of a sighted person. The teacher must believe that which occurs in the classroom. If the doctor insists the child has light perception only, and the child uses his or her eyes in classroom activities, the teacher's acuity measurement is far more valid. Doctors can be wrong. The teacher should give his or her observations to the examiner. If the examiner is not receptive, another doctor should be consulted. Nobody can be expert enough to fully evaluate the visual function capabilities of a child without the teacher's help.

Acuity Measurement

The actual acuity measurement can be meaningful to the teacher if there is an open dialogue between the teacher and doctor. Every examiner has his or her own technique for taking acuities. If the teacher is familiar with the methods used by a

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*E. Mehr and A. Freid, *Low Vision Care.* Chicago: Professional Press, Inc., 1975.

particular doctor, then, when an acuity of 20/200 is recorded, it will have some significance. Acuities are recorded as follows:

No light perception (NLP). The child is totally blind.

Light perception (LP). The child can tell if lights are present in the room.

Light projection. The child can tell where the light source is located.

Hand movement (HM). The child can recognize motion at a distance of 10 feet. (I would prefer to call this form and shadow acuity.)

Finger count (FC). This is an invalid acuity measurement. If the child can count fingers, he or she can respond to some characters on an acuity chart. Do not accept this as a measurement of visual acuity. Somebody is simply too lazy to spend a few extra minutes to obtain a reliable measurement.

20/200 vision. The child is legally blind and can just see this size letter in the examiner's office. This does not mean the child is blind. A child can enjoy a wealth of visual input with this acuity loss.

An accurate measurement of visual acuity is important to demonstrate to the patient how much vision still remains, not how much has been lost.

The next procedure is the determination of a refractive error. Many so-called blind or visually handicapped children are the victims of a poor refraction. The deaf-blind are often misdiagnosed because of the severe communication barrier. The examiner must depend on objective measurements (those requiring no response from the child) in conjunction with teacher observations to accurately determine the presence of a refractive error. A child may be legally blind because no one has taken the time to find a large astigmatic refractive error.

The teacher's help can be used to verify a proposed prescription. A spectacle correction may be placed on a child, and the teacher is asked to observe any significant changes in the child's behavior or performance. If a child refuses to wear lenses, this should be reported to the doctor. The prescription may be off, or the child may be confused by the new visual stimuli the lenses present. It may be a simple matter of an uncomfortable frame. The teacher, not the doctor, can make these observations. It is the responsibility of the doctor to make any necessary changes based on these observations.

Magnification

When the doctor is convinced that the reduced acuity is due to pathology and not to a difficult refraction problem, magnification needs are evaluated. Magnification is a means of getting a larger image focused on the retina of the eye. This can be accomplished with linear, angular, and size magnification techniques.

Linear magnification is a simple process of bringing things closer. We normally read at 30 cm and, if the same material is held at 15 cm, it will be twice as large. Lenses are used to focus the enlarged image on the retina. The lens does not magnify; it just focuses.

Angular magnification is accomplished through the use of appropriately separated lenses. In low vision we use Galilean telescopes to provide angular magnification for viewing distant objects. This type of magnification is used in binoculars.

Most teachers are familiar with large print. This is a form of size magnification. The actual size of the object has been enlarged.

The teachers and parents express their opinions as to the child's needs to function visually at home or in the classroom. The examiner must find the magnification needed to satisfy these needs.

Providing Correction

Once the approximate amount of magnification needed to perform specific tasks is determined, the examiner can design an appropriate aid to provide that magnification. The specific aid designed will depend to some extent upon the teacher's report on the following:

1. What skills are being developed in classroom activities now?
2. What does the child need to identify in classroom activities?
3. What are the total activities the child is involved in, and what problems are encountered?

The teacher's expertise is in getting the child to experience his or her world. The low vision specialist must determine if the child is using his or her residual vision to its maximum to fully appreciate the teacher's efforts.

The correction may be a conventional lens. It may be a referral for mobility training. It may be an optical aid for reading, or it may be a telescope for spotting distant objects. If the child does not use his or her eyes, a simple magnifier may be prescribed and used in the classroom in an effort to get the child to appreciate the concept of magnification. Once the child learns to use the magnifier to enlarge things, a more formal treatment program can be initiated.

Types of Aids

The types of aids that are available are hand-held and stand magnifiers, spectacle-mounted microscopes, telescopes, and nonoptical devices.

Deaf-blind children often use hand-held and stand magnifiers. These provide sufficient magnification for most classroom activities. They are inexpensive and can be used to teach the child to appreciate magnification. Magnifiers can be used in conjunction with spectacles and/or large print.

Spectacle-mounted microscopic devices are usually reserved for higher magnification needs. They require that the child accept wearing a spectacle correction and learn to work at distances of 2 to 5 inches. Also, the child must learn to hold the material right at the focusing point of the lens. These aids are usually a little more expensive and a little more sophisticated than the hand-held and stand devices. Once the child becomes comfortable and proficient in the use of a magnifier, a spectacle microscopic device may be considered.

Telescopes are the only devices we have to improve distant vision. These devices cannot be worn full time because of the increased motion when viewing through the telescope. A sophisticated telescopic bifocal is available, but is rarely used for the deaf-blind child. This device allows the patient to view through a miniature telescope mounted in the upper portion of the spectacle frame. The lower portion of the correction is a conventional spectacle lens. The patient learns to spot through the telescope and then walk using the spectacle lens. The deaf-blind child will appreciate some of the inexpensive hand-held telescopes. Any of these telescopes can be carried in a pocket or tied around the neck and used to spot objects. Children can be shown how to use the telescopes to aid their mobility.

Nonoptical devices cover a wide range of services. The two most frequently used nonoptical aids are lighting and large print. Many times a child's vision can be substantially improved by using the appropriate amount of light. One child may need to use a 100-watt bulb 6 inches from the material, and the next may work comfortably in semidarkness. The teacher should experiment with different lighting and have the doctor verify the findings.

A pair of sunglasses can be very important to some children. They may be so sensitive to light that they become essentially blind when they are forced to go outdoors. The sun correction is far more important to such a child than all the magnifiers in the world.

In the classroom the children can use large-print books. Felt tip pens should also be used with bold line paper. When working from the blackboard, the teacher should use a soft chalk because it leaves a broader line.

Using Optical Aids

The most important aspect of prescribing an optical aid is training the child and teacher to use it. A small amount of in-office training will occur, but most of the child's experiences with the aid will occur in the classroom. It is vitally important that the teacher understand the purpose of the correction and its limitations. These are not conventional lenses that one can pick up and start wearing. The child needs time and practice to learn to work in his or her new, magnified world.

Often a child will be found functioning totally in braille when he or she is able to function in print. When questioned, the teacher will respond that the child could not use the aid, or it was too difficult and he or she was too slow in print, or the child functions better in braille, and so forth. Most of the reasons given point to the fact that the teacher did not understand the purpose of the correction. *An optical aid is not meant to replace braille.* Both mediums of communication should be taught. A child will be slow reading in print at first, especially if he or she has been brought up in braille. Using an optical aid is not easy, but it may well be worth the effort.

In this presentation my major emphasis has been that the deaf-blind child is an individual and will respond to his or her handicap in his or her own personal way. This response to the child's vision loss must be taken into account in prescribing a correction, regardless of the acuity numbers. I am interested in how the child uses his or her remaining vision. No single examination procedure will be appropriate for all these children. Time must be spent with the child on case history, refractive error and acuity determination, evaluation of magnification needs, and the provision of an aid. This cannot be done in a 15-minute office visit. In fact, it cannot be done in the office alone. Most of the child's learning and experiencing occurs in the classroom. These activities must be considered along with the complicated interrelationships of his or her multiple handicaps in order to prescribe appropriately. The teacher is the person who will be in a position to monitor the child's progress in utilizing his or her residual vision. As such, the teacher must be informed as to the importance of the aid, its proper use, and the frustrations that can be expected as the child learns to use the device. If there is not an open channel of communication between the teacher and doctor, the child is not receiving the best in vision care.

Instructional Materials for Use with Deaf-Blind Children

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In considering a presentation to this institute, I was initially apprehensive. I am not greatly experienced in working with deaf-blind, rubella-affected children. However, I do feel that I can share with you some basic information that can be easily applied to your work with the deaf-blind. This information deals with retrieval and use of instructional materials. Specifically, my purpose is twofold: first, to inform you of teacher-directed and nonteacher-directed retrieval systems, and second, to help you effectively use materials once they are retrieved. The scope of this presentation deals specifically with systemized means of retrieval and with a systematic usage of materials.

Teachers are potentially the most influential, most sensitive, most flexible, and most divergently responsive components of our educational system. It is the teacher, perhaps more so in the deaf-blind field than in any other, who will provide the most direct influence on the child in the least amount of time. It is the teacher, naturally, who can do best that for which he or she is trained; namely, diagnose individual needs, interact with individuals, provide activities for skill acquisition for individuals, and identify and encourage a self-direction for individuals, however limited that self-direction may be. But it is the teacher, more than any other component of the educational system, who finds herself or himself not being able to meet educational goals set for pupils. This inability has been explained in a variety of ways: a lack of quality teacher-training on the part of our universities and colleges; limitations of conventional teaching; a lack of instructional materials; or, if the teacher has materials, a lack of knowledge of how to use them effectively. My bias is that the latter two factors hold true in most cases where teachers are not meeting goals.

In an effort to eliminate the first of these, that is, a lack of instructional materials, let us now focus on the effective retrieval of instructional materials. Usually, three things might be assumed before one begins to select materials for use by children: either one has all the money one could possibly use; one has barely enough to get by on; or one has an adequate budget but nothing fabulous. The latter, generally, holds true for most teachers; whatever the budget situation is, the teacher needs to know how to get the most for his or her money. The teacher particularly needs to know how to get information about materials before purchase or use. Perhaps most of all, he or she needs to know where to get materials at no cost, either on a loan or permanent basis.

Teacher-Directed Systems

The best way I know how to do this is to be well-versed on retrieval methods and systems; however, I realize that there is so much information about everything that it is impossible to know for sure about anything. A teacher might never have the whole story no matter how much he or she searches. There are simply too many journals, too many programs, and too many materials released each year for one teacher to be able to know about all of them. This is not to say, however, that there is no means of effective retrieval of information about products. Some of the most neglected means of retrieval, yet very practical in terms of time and money, are those systems I call teacher-directed. These are simply systems which are established and controlled directly by the teacher or, perhaps more commonly, by a teacher or paraprofessional within a group of teachers.

One such system consists of a file of publishers' catalogs. I have often seen teachers who select all of their materials from publishers' catalogs. This collection of catalogs often consists of four or five catalogs. Because over 400 companies deal entirely in educational materials, I doubt that five catalogs are enough. A publishers' catalog file can be a very effective tool in retrieving information and materials. To set up such a system, one must first of all be on the mailing list of such publishers. This can be done by writing a postcard to companies, asking to be placed on their mailing list. (You can obtain a large list of addresses from your local school supply company.)

Once you begin receiving catalogs, you should classify them, cross-reference them, and file them.

To classify a catalog, take a good look at it before filing. Ask yourself such questions as: What does the company supply? For what populations does the company supply? Is it regular or special education? Can the materials possibly be used with my pupils? What specific items might I be interested in at a later date when funds are available? Jot down answers to these questions, and file them as a reference inside the front cover of the catalog. In order to cross-reference the catalogs, you might set up a three-by-five card catalog system, which might be subdivided into sections such as aids, mobility skills, self-concept, communication, and the like. As you receive a catalog, look through it. If the materials within the catalog provide skill acquisition for one of your sections, jot down the company's name on a card and file that card under the skill area. In this way you can look under specific skill categories and see which companies provide materials to help teach that skill. Another important usage of such a system might be the sending out of questionnaires to the publishers. Ask such questions as: Does your company offer free demonstrations of its materials? Who is the local representative of the company? Does the company offer free trial-usage periods for its materials? It is essential that you use these files and update them. The work is very limited in ratio to the possible information gained.

Along these same lines, other systems I have seen used effectively are "begging" files and "free" files. A begging file is no more than some systematic way of letting yourself know that other teachers within your area have materials available for your usage. Often, someone across town or even across the hall has just what you need to teach Johnny a specific skill, but you do not know about it. How do you find out? Again, seek information by dropping cards off to teachers, calling them, or even going to see them. Ask such questions as: Can the materials be loaned? If so, for how long? What types of materials might he or she have in order to teach a given skill? Do not forget to let the other teacher know that you might have something he or she can borrow. Free files are another retrieval system made up of either card files or folders that show which companies, agencies, or clubs offer free materials for classroom use. There is often some agency willing to provide free new or used materials, money, or even time. Why not send out questionnaires to every company, agency, or club in your community? The worst they can say is no.

Nonteacher-Directed Systems

Another means for retrieval are those systems I call nonteacher-directed; that is, systems available to the teacher but not established or controlled by the teacher.

The most comprehensive of such systems are the national network of Area Learning Resource Centers (ALRCs) and the Regional Resource Centers (RRCs). The goal of this national system of resource centers is to facilitate equal educational opportunity for all handicapped children. To do this, resource centers promote the availability and utilization of instructional and learning processes and products that will meet the educational needs of handicapped children and youth. The ALRCs and/or RRCs will provide to you any needed assistance via materials or consultations in order for you to meet specific educational objectives for your pupils. Because this service is federally and state funded, there usually is no fee.

A private company, the Select-Ed Prescriptive Materials Retrieval System (PMRS), offers a precise classification and indexing system for instructional materials. It is based on a continually expanding range of instructional materials. More than 250 publishers and distributors of instructional materials are listed. Each year new materials are added to the system. The company provides an analysis and evaluation of literally thousands of materials on a quick, easy to use, retrieval basis. The biggest criticism of the system is its cost, which is approximately $2,000 at present; however, many school districts and local instructional materials centers have purchased the system.

More directly related to teachers of deaf-blind children are three major information and materials sources. These are the American Printing House for the Blind, Regional Centers for the Deaf, and Regional Centers for the Deaf-Blind. I will not go into the specific services provided by these systems because I feel that you are probably most familiar with these already.

Another nonteacher-directed retrieval system would be the Information System on Adaptive and Assistive Equipment Related to Travel. Funded by the U.S. Office of Education, this project develops, indexes, and catalogs equipment used in schools for physically handicapped children. Since a high number of deaf-blind pupils also have physical handicaps that affect mobility, you might want to have some information on this system. The system provides an index and analysis of adaptive and assistive equipment used for the physically handicapped. To enter the index, the user reviews the functional need, selects a major category which is related to that need, and proceeds to a corresponding section of the locator book. The user then follows a functional breakdown of the system to the desired equipment needed. The analysis of the equipment provides the user with information such as company, cost, use, and the like.

The last system of nonteacher-directed retrieval systems that I would like to discuss may not at present be available to teachers of the deaf-blind. It is essentially a new system called the Computer-Based Resource Unit (CBRU). This system ties together the special characteristics and needs of pupils with the multitude of ideas, materials, and activities submitted to the computer's memory bank by groups of teachers working cooperatively to design various units. The computer sorts through all the data and selects that which matches each child's profile. It then prints out a resource guide that provides small group and large group activities, instructional material suggestions, measurement devices to meet objectives, individual activities, and individual material suggestions. This system includes a unit on Movigenics, which deals primarily with perceptual-motor activities. I do feel that the system will be expanded and revised to provide services to teachers of deaf-blind children.

Effective Use of Materials

Let us now turn to the effective use of instructional materials. Presumably, teachers have mastered the essentials of the subject matter or skills they teach. For teachers of the deaf-blind, these skills are more often than not perceptual-motor skills. Although a teacher may know the subject matter well, he or she may not have thoroughly analyzed the kinds of learning tasks involved. To analyze the tasks, the teacher must set broad educational goals and specific instructional objectives. While doing this, the teacher sets forth an instructional sequence that provides for the most effective use of his or her instructional materials.

A broad educational goal is usually very general and rather encompassing in scope. Broad educational goals provide guidelines for generating related specific objectives. They usually provide a relevance for specific instructional objectives and give the teacher a more complete picture of his or her efforts. They also facilitate communicating with nonprofessionals, as well as providing a way to easily incorporate the values of society and the community. Two broad educational goals which I might establish if I were teaching the deaf-blind would be the following:

1. Teach young deaf-blind children the awareness of their environment.
2. Teach young deaf-blind children to be independently functional and mobile in their environment.

The preceding goals do not provide any specifics of what skills are to be taught or how the teacher will know when the learner acquires such skills; however, they do provide an orderliness for generating specific instructional objectives.

Instructional objectives provide a more specific description of learner behaviors. In setting instructional objectives, the teacher is required to analyze behavior. For organizational purposes this is usually done in three categories: (1) psychomotor; (2) affective; and (3) cognitive. I suppose most of the objectives for a deaf-blind child would fall into the psychomotor and cognitive domains. To allow for specificity of instruction, these areas can be broken down even further. The psychomotor classification of objectives usually includes those behaviors that deal with muscular responses, whether they be perceptive and guided responses or complex and overt responses. Within the cognitive category, objectives might be broken down into such classes as memory, application, and evaluation. At any rate, this method of looking at instructional objectives gives the teacher a description of what type of behavior the learner is to develop. However, in order to teach that behavior, the teacher must examine the sequence of the learner's task as he or she tries to master the behavior. This is essentially a systems approach to instruction. It makes mastery of a behavior possible by identifying small learning steps, each of which can be mastered with adequate practice. Once these small steps are established, the teacher will need to establish the criteria for their mastery. That is, by what measure will the teacher know that the learner has gained mastery? One should never require a criterion measure that is not within the stated objective. That is, if the objective is to have the learner place a peg in a hole, the teacher should not measure the complete process of picking up the peg, placing it, and then removing it.

The teacher should measure only what is within the objective. For each objective stated the teacher needs to list the activities that will help the learner perform the intended responses. This equivalent practice relates most directly to the effective use of materials. The learner must have the equivalent practice of doing the response before he or she can meet the criterion of the response. The criterion for selecting the activities is to choose those that will help the learner acquire practice needed for accomplishing the objective. It is important at this step in the instructional sequence to use many varied materials to teach the same concept or skill; however, the teacher does not want the child to necessarily show mastery of a particular toy or material. The toy or material is being used to acquire mastery of other skills. If the objective is to have the learner place pegs in holes, other objects should be offered along with the pegs.

The teacher should use as many objects, materials, and aids as are available to teach a given skill. A list should be kept of the materials that are being used to work with a particular objective. Others might use the same materals to teach the same objectives to other students. Each instructional sequence that is designed for a given instructional objective should be evaluated during its use and upon its completion. The teacher should continuously ask such questions as: Is the sequence offering clarity to the user? Does the sequence allow for optimum attending? Does the sequence need to be revised in terms of pace, sequence, organization, size of steps, and the like? This evaluation will allow for revision. Revision is perhaps the most important aspect of the instructional sequence.

Conclusion

My presentation has been an instructional sequence. I have tried to set broad instructional goals as well as specific instructional objectives. The instructional sequence I have described can be outlined briefly as follows:

1. Set broad educational goals.
2. Set specific instructional objectives in behavioral terms.
3. Allow equivalent practice.
4. Evaluate.
5. Revise.

Developmental Assessment and Evaluation Through Teacher Observation

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By means of the various medical and clinical assessments, organ impairments can be identified and often are corrected; frequently, audiological and/or optometric aids may be prescribed. This is only the beginning of assessment, for understanding how children function, learn, and develop from day to day over a span of weeks, months, and years requires careful observation, temporary assessment of functional behavior, structured orderly programming to elicit and guide behavior, and continuous reevaluation and reprogramming. In severely damaged children, it is virtually impossible to separate developmental assessment from programming because they are interactive and mutually related to each other. Therefore, I see assessment as a process just as development is a process.

Most of this assessment and evaluation will be the responsibility of teachers and parents who work with the children daily. Every stage and dimension of development and behavior can be observed if one has the ability to sensitively "read the children's behavior." To be able to do this effectively requires that we observe patterns of behavior (1) in a free, unstructured setting; (2) in a semistructured setting in which the range of functional behaviors is limited; and (3) in a more structured environment in which behavioral possibilities are actually controlled.

To develop these concepts a bit more specifically, let me discuss behavioral domains within the sequential manner in which they tend to emerge as suggested by some theoretical ideas. I shall give these behavioral domains names which are frequently utilized; these behavioral domains and the overlapping nature of their emergence are shown in Fig. 1. As I talk about these, please keep in mind that children do not develop or function in isolated domains; but, for purposes of clarity in this frame of reference, I shall address myself to specific realms of behaviors one at a time with your understanding that all developmental and functional behaviors may be occurring simultaneously.

Affective Behavior

Affective behavior has to do with feelings, attitudes, motivations, eventual values, and decision making. Feelings emerge and develop in the process of human attachment during the nurturance process. Pleasing, satisfying relationships foster feelings of love and security and trust. Without the holding, cuddling, and close human interactions, frustrated responses and feelings of fear, distrust, insecurity, and anxiety may develop. In our severely damaged children, the "love relationship" is disturbed. Because of their damaged nervous system, post-rubella children may need a longer, more sustained, and highly consistent relationship with one or two persons to begin to form human attachments. Many of the means for stabilization of attachment behaviors rely upon mutual tactile, visual, and auditory feedback patterns. These processes within the child may be severely damaged or totally inactive in some cases, both from the standpoint of reception and response.

Rubella children may resist touch because of oversensitivity of the nerves in the skin; yet they may need to be touched and fondled until they can accept the stimulation of a variety of tactile stimuli from human beings and from many textures or real-life objects. In some instances, care will need to be exercised that some children do not become so fixated or too highly selective in their touch reception that they seek stimulation just for the sake of stimulation. When such behavior is observed, intervention is necessary, and it is time to introduce a new kind or type of stimulation in order to help them move beyond stereotyped behavior.

They may be uncomfortable or in actual pain because of medical problems. When behavior suggests resistance of this sort, the parent or teacher needs to try to find the source of discomfort. One can often try a conditioning approach that gives the child time to accept the touch or sound being introduced. Impairments in the auditory system may disturb balance and movement patterns. When this assessment is made, a careful series of selected movements for a specific purpose may be appropriate. The need for constant movement may be minimized until the child can adjust himself or herself to movement and accept movement for a specific reason.

Cataracts, glaucoma, or other abnormalities of the eye itself may make the world a hazy blur. New lenses, or any type of magnifying device, may produce a kind of "visual noise" which is confusing to the child; he or she might actually resist using the visual capability he or she has. Often children will engage in "light play" or meaningless visual stimulation, which is really a means of escape from looking and seeing consciously. When assessment is made of such behavior, it is appropriate to find something specific for the child to see for a particular purpose and then direct the child to look, even to the point of moving the child's head and directing his or her visual attention to what you want the child to see. Perhaps one of the reasons behind the problems in sensory awareness and attention, which are absolutely necessary for the child to receive any information through the senses, is the difficulty in arousing the damaged central system to the point of sensory reception. When the sensory reception system is upset or disturbed, messages from any sense or at any level are received with great difficulty if at all.

Because the human organism has a "hunger" for stimulation and contact to reach a state of homeostasis (satisfaction or equilibrium), then, with additional stimulation, heterostasis (upset or disequilibrium) requires meaningful input in order for the balance to be restored. This continuous cycle of accepting and using input from the senses is the basis of learning and later becomes a factor in motivation. With any type of upset in the trust or love relationship, instability in attending to and accepting sensory stimulation may be noticed and will naturally result in regressed behavior. A child may regress when his or her teacher is replaced by a new one. A new sense of trust and a new "love

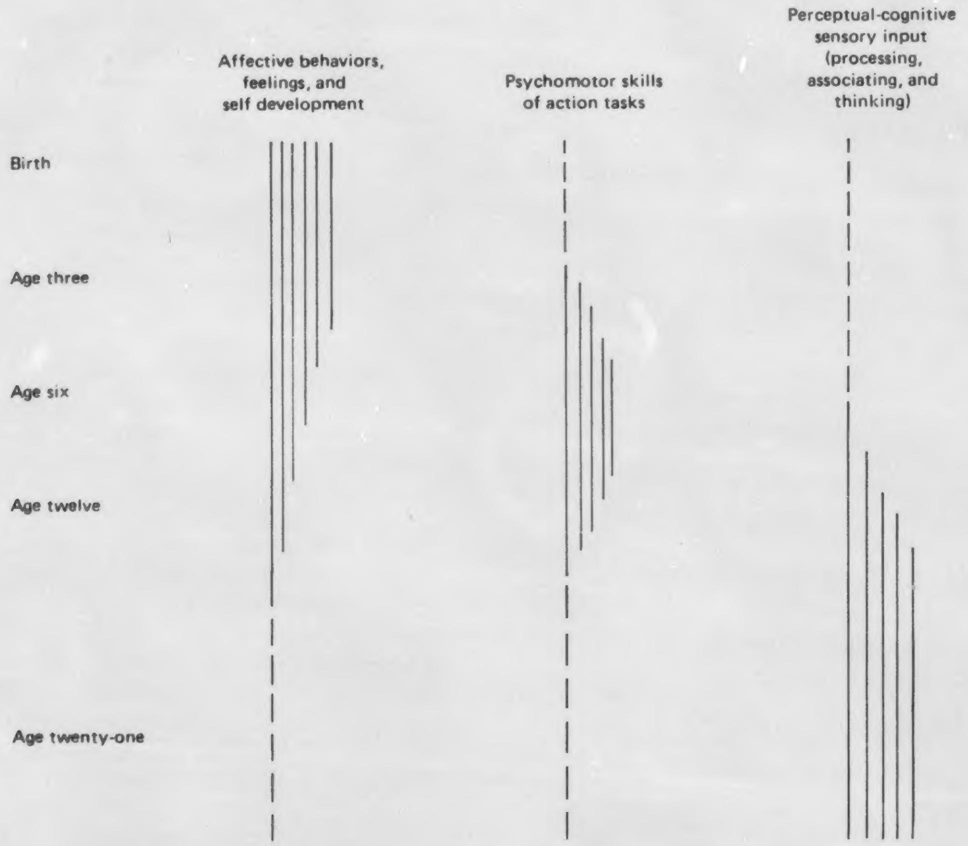
Affective behaviors, feelings, and self development
Psychomotor skills of action tasks
Perceptual-cognitive sensory input (processing, associating, and thinking)
Birth
Age three
Age six
Age twelve
Age twenty-one

Fig. 1. Developmental behavioral dimensions

relationship" have to be established before the child can go forward with learning and be able to control behavior and responses. When these ideas are understood, the teacher can understand the child and herself or himself in relation to the child; the teacher can know the appropriate stimulation to select and when to continue to invite the child's attention–when to push and when to "tread water" for a time.

With some stability in the trust relationship, the children are able to relate to and give attention to things–food, clothing, objects, and everyday items in their world. They can now experiment with self-directed acts when they can understand the meaning of the control and autonomy which their actions bring. A feeling of "what I do is important" begins to emerge. At this point, the teacher needs to step back and assess the child as he or she functions without help. The teacher needs to enter the activity only to support or to encourage the child, even if the child's actions are only an approximation of skill.

In their relationships with children, teachers must be sensitive to and be able to perceive the stage–the affective developmental age–at which each child is. The teachers should move with the children and respond to them as they demonstrate need and reach for these increasingly complex interaction patterns which we call social behavior. This is the basis for all future skills and thoughts as well as for the self-image of the child.

Psychomotor Behavior

Psychomotor or sensorimotor concrete behaviors are another developmental dimension. With the feeling of "I am" somewhat stabilized, the child is ready to move toward "I can" and "I will" behaviors–actions which mean something. These probably will need to be evaluated one at a time and taught in very small incremental steps. Rubella-affected children may be able to hear speech or to see gestural or action symbols expressed manually but be unable to process them into meaningful receptive language to know *what* to do; if the children have blurred or distorted visual images, they may be unable to know what to do from imitation. Actions which cause something that has meaning to happen may need to be shown through body movement; then the child's ability to repeat that movement should be evaluated. Teachers need to observe carefully whether or not reception of language or action symbols is present and whether or not visual imitation is possible; if not, then teachers should teach that action by actual movement and manipulation of the child in order to perform at least the approximation of that skill.

There are many developmental scales that show each sequential step in the socialization and motor dimensions. These scales can be adapted, elaborated, and used as a basis for creation of individual scales so as to check off where the child is and what specific actions can be performed. By informal and structured observation, teachers can draw a profile of interaction patterns of functional skills; in other words, find the child's "skill age." Careful assessment of these very basic concrete behaviors is necessary. Skills require organization of what one wants to do as well as organization of how to do it. Feelings of the action can make it pleasurable and satisfying to the child because the child knows what he or she has done, and it has meaning.

Perceptual-Cognitive Behavior

Until the child develops a good-feeling concept of self and what he or she can do, efforts to stimulate the child in perceptual and cognitive areas may be an exercise in futility. Sometimes we attach importance to knowing about things rather than knowing how to function. How does perceptual-cognitive behavior develop, and how can we assess the child's development along this continuum? The child can learn only by the successful utilization of his or her senses. The senses are involved in all motor movement and in all motor skills, but at a different level for the purpose of movement or for the purpose of stimulation of a feeling of functional response.

The use of the senses for the purpose of learning and perceptual development requires that there be a purpose in their use. For perceptual development, there must be intentionality in the search for a specific thing to see or to hear or to touch, and that search must result in meaningful input. Sensation may be the first level of sensory stimulation; reception probably follows, but it may be at a preconscious level. Discrimination between different textures, sounds, or objects requires attention and a conscious level of perceptual understanding. Recognition is a higher perceptual level that enables the child to place a specific name on what is perceived; recognition requires that understanding and meaning be a part of this perceptual level. Abstract thought and decision making about sensory input is at the highest level of cognitive development when associations are possible, functions are understood, and groupings and categories are utilized, first with concrete objects, then with words and symbols.

Knowledge and understanding of this sequence permit the teacher to assess the child's level of receptive or perceptual behavior and to plan experiences and activities that are appropriate to the level of the child. Trying to teach words and symbols for recognition prior to careful assessment of that child's ability to make numerous discriminations through all senses may frustrate the child, but there is little chance that the child can actually learn such concepts to the extent that he or she can incorporate them.

To understand the developmental sequence related to all sensory learning is imperative for the teacher in order to assess what the child is ready to accept and to remember. Selection of real-life concrete objects, materials, and actions that have meaning for a child at each point is the key to teacher assessment and programming, so that each step up the ladder of progress is undergirded with a solid base upon which to stand and to reach. Sensitivity to these principles is the secret of the process of assessing, programming, and evaluating.

Environmental Coding—An Approach for Facilitating Cognitive Development in Deaf-Blind Children

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The education of deaf-blind children in the United States has had a rich and dramatic history. In today's special education literature, the Laura Bridgemans and Helen Kellers are convincing examples of what one's concern for humankind can accomplish with patience and empathic understanding. So outrageously conspicuous is the severity of impairments in human functioning that progress in deaf-blind education appears miraculous to the layperson and, at times, inexplicable to the professional.

Being in a world where nothing exists beyond the fingertips, where visual and auditory qualities of objects, events, and their relationships in distal space are not prehensible, is indeed being egocentric—with neither sight nor sound inviting movement. There is no going to nor coming away. The external world is rendered limitless, without locations and constancies. Is it not hard to imagine a child in this state of solipsism realizing any sense of purpose to behavior? This is the classic picture of the deaf-blind child—a child, to borrow the Perkins' metaphor, of the "silent night." Today, this child is more appropriately termed a child of the "hushed dusk," as Josephine Taylor often has stated. Indeed, the rubella child with congenital birth defects presents an enormous challenge to a benevolent society. But, the urgency of meeting this challenge goes beyond meeting the immediate needs of these children. It requires establishing the efficacy of multiservice programs for all severely multihandicapped children.

Antecedents to Current Practices

If anything at all positive could be said about the 1964-65 rubella epidemic, it would be its timely occurrence. Two very important trends, one psychological and the other political, were gathering momentum at this time; and, coming together, they gave the parents of an estimated 20,000 surviving children (Dantona, 1970) great hope. These were the so-called early experience movement and the emergence of President Johnson's Great Society.

Combining Hebb's neuropsychology, modern information-processing theory, and Piaget's naturalistic observations on cognitive development, Hunt (1961) attacked the fixed notions of intelligence that he believed had been dominating American psychological thinking. B.S. Bloom (1964), in synthesizing psychometric data depicting the stability of measurable human characteristics, concluded that a disproportionate amount of one's intelligence is acquired before entering school. Thus, evidence was confirming, to the satisfaction of many, that neural structures responsible for problem-solving ability are most susceptible to modification from the environment early in life (plasticity hypothesis) and that environmental conditions can maximally affect such modifications at certain stages of growth (critical periods hypothesis).

Much of the rationale, at least on psychological grounds, for equal educational opportunity and early intervention during the construction of the Great Society came from the early experience movement. Early intervention, then, seemed imperative for children with the rubella syndrome if the devastating effects of severe sensory deprivation were to be prevented. Although other congenital birth defects accompanied the sensory impairments of these children, the extent of organic damage to intellectual functioning could not be ascertained. With great optimism, multidisciplinary intervention procedures were initiated, resulting in the early removal of cataracts and the early prescription of hearing aids. Thus, the effects of sensory deprivation anticipated by the early experience advocates were greatly minimized.

Educators who sought to improve the child's level of functioning were confronted with the classic problem of the match. Given knowledge of the child's developmental status, what would be the most appropriate environment for facilitating the child's further growth? In practice, however, this problem raised serious questions regarding the appropriateness of traditional models of teacher preparation.

New Directions for Teacher Education

Within the blindness system, surveys reported by Lowenfeld (1968) and Graham (1970) revealed a disproportionate increase of multiple impairments among blind children. The children who now receive educational services for the blind are, for the most part, multihandicapped. Moreover, the recent advances in ophthalmic medicine, optometry, and audiology have brought about substantial increases in functional vision and hearing. Such fluctuations in the severity of sensory impairment, etiology, incidence, and prevalence render educational classification, in accordance with the legal-medical model, inefficient. Once, education of the blind simply implied modality substitution. When one considers the case of the severely handicapped rubella child, modality substitution appears superficial at best.

With the landmark legislation of the Johnson administration, multidisciplinary treatment provisions were made available on a regional basis. The ten original regional centers for deaf-blind children became sophisticated in diagnostic, documentation, and case-finding procedures. Clearly, treatment of these children could not be predicated upon the mere summation of knowledge about the deaf and the blind. Evidence was beginning to show that the education of rubella children required skills in developmental diagnosis, task analysis, behavior modification, total communication, sensory stimulation, and perceptual-motor training. Thus, categorical preparation of teachers appeared insufficient and, to some extent, counterproductive.

In the brief history of educational programs for the rubella child, the difficulty in knowing where to begin stands out as the most challenging intervention problem. Many programs that placed heavy emphasis on oral communication and cognitive classification tasks have been abandoned. These have been replaced by the techniques developed by Van Dijk and his associates in the Netherlands and by activities that place greater stress on adaptive behavior and self-help skills. Education must begin with the most primitive and egocentric movements for they initiate and come to mediate contact and eventual interaction with the external world. As the child progresses from this basic beginning, the educator is constantly faced with the problem of the match.

The implication for teacher education is to focus on human development. Knowledge of the developing child, his or her unfolding behaviors and corresponding functions, together with a careful analysis of what there is about the environment that can potentially stimulate further growth and differentiation of human functioning, should constitute the core of preservice and inservice teacher education in this complicated field of the multihandicapped. This presentation will consider primarily the environmental side of the match. Structure in the environment will be examined at various developmental levels when tendencies ordinarily exist for discerning such structure. Procedures for visually intensifying structure, referred to here as environmental coding, will be described with the hope that direct teaching activities can be enhanced by providing the child with more intense and selective visual-motor experiences.

Normal Developmental Data

To determine successful intervention strategies for educating deaf-blind children, one must have extensive knowledge about normal child development. The interaction between the developing child and his or her environment is predictable. This interaction results in the attainment of increasingly complex levels of competent functioning. The reciprocity involved in this interaction, environment-modifying behavior and behavior rearranging the environment, has been described with remarkable insight by Piaget and his associates.

Observations of Infantile Sensorimotor Behavior

White (1971), in summarizing some of his research projects that were based on the plasticity hypothesis, has elaborated substantially on Piaget's observations and interpretations of sensorimotor intelligence during the first eighteen months of life. This period of cognitive development results in the child's accomplishment of two very important abilities: (1) the sensory guidance and control of body movements; and (2) the appreciation of the permanence of objects in space without direct sensory inspection. In addition to accumulating more detailed information on the normative growth of these important abilities, White wanted to identify those components of the environment that could differentially affect the rate of such growth. Thus, the hastened or delayed appearance of certain sensorimotor behaviors in response to environmental manipulation could lend support to the plasticity hypothesis and, more importantly, specify the strategies for early stimulation.

Debate is continuing over the issue of whether or not the initial visual behavior of the neonate reveals active visual search or the mere passive centering of the fovea to the presence of a strong stimulus in the periphery. Either way, there is visual response to changes in the environment if only on a reflexive level. The beginnings of eye/hand coordination can be further specified by consideration of the tonic neck reflex. Here, a lateral extension of the arm will elicit head turning in the same direction. Thus, the artifacts of visually guided reaching can be observed to operate on an initially reflexive level.

By the end of the second month of life, visual/motor behavior has achieved remarkable sophistication (White, 1971). The ability to focus has almost reached that of an adult. Approaching visible forms elicit converging responses. The infant's hand is the subject of sustained inspection. Overall, there is dramatically heightened visual interest. The infant's "discovery" of his or her hand, with the shifting of gaze to nearby objects, leads to smooth visually directed reaching. At two months accurate swiping responses can be observed. Accurate reaching occurs between three and five months. Finally, at eight months the infant can be observed placing objects in various locations within his or her prehensile space.

The consolidation of visual and tactile-kinesthetic space leads to the acquisition of object permanence. The actions performed on objects in space serve to reify the object's corresponding visual impressions. As a consequence of the child's reciprocal interaction with the environment during the sensorimotor period, body is differentiated from nonbody, body parts are distinguishable by function, and the external world is somewhat objectified since the child can evoke an image in memory representing an object apart from his or her direct verification.

Observations of Preschool Perceptual-Motor Behavior

Once the external world becomes permanent for the child (independent of direct sensorimotor verification) and exploratory movements are brought under sensory control, the level of cognitive functioning becomes representational. That is, the two-year-old child can evoke an image in memory of familiar objects, persons, and relations. Such an image is, however, concrete and unidimensional. The young child does not appreciate novel complexity or symmetry. Nor does the child appreciate the range of perspectives available to other viewers. Piaget and Inhelder (1967) have identified several stages in the child's development of the concept of space. In a synthesis of these and other findings, Jackson (1972) reviewed the course of tactile-kinesthetic or haptic perceptual development in normal preschoolers. He attempted to establish the importance of hand movements and exploratory strategy in the education of multi-handicapped young children. For Piaget, memory images that are used to mediate thought are constructed in stages by the maturing capacities of the hands in reciprocal arrangement with the discoveries and modifications the hands can perform. The development of haptic exploratory strategy was found to be predictable. More importantly, however, it can be implied that such development occurs in response to the nature of the materials presented. In the case of sensory-impaired children, the discovery of materials that would best foster perceptual-motor or cognitive development cannot be accomplished by fiat.

Some rather remarkable consistencies appear in the results of research on the development of haptic perception conducted across differing cultural settings and on the basis of disparate theoretical notions. These studies include the work of Piaget and Inhelder (1967) on the ontogenesis of the image in the naming, recognition, and reproduction of forms and shapes; the experiments of the Russian reflex psychologists on the origin of the motor copy in perception (Zaporazhets, 1965); two Piaget and Inhelder replication studies undertaken in the United States on sighted preschoolers (Page, 1959); and in the comparison study of blind and sighted preschoolers (Gottesman, 1971). While caution should be exercised in prescribing environments on the basis of these studies, experimental implementation may certainly be indicated at this point in time.

Piaget and Inhelder (1967) allowed children between two and seven years of age to haptically explore a variety of objects. With both hands reaching around a screen that occluded their vision, children were encouraged to actively manipulate a series of familiar objects, topological shapes, and euclidean forms. Subsequently, the children were asked to either name the objects (in the case of the familiar ones), recognize the objects from a visible display or drawings of them, or reproduce the objects by means of drawing. According to Piaget and Inhelder (1967, p. 19), the children were confronted with two distinct tasks: (1) the translation of tactile-kinesthetic perceptions into visual ones; and (2) the construction of a visual image that incorporates the tactile data and the results of exploratory movements.

The problem posed by the first task is not a new one for such children. At three to five months, children have already coordinated the looking and touching schema. They can initiate facial expressions without visual feedback; however, the introduction of the geometric forms, which are not familiar to the child as concrete instances, poses the problem of greatest concern. Here, the child is not merely reconstructing the tactile-kinesthetic elements of a previously acquired visual image. Rather, he or she is constructing for the first time a visual image on the basis of haptic exploratory data alone. In this case, therefore, one gains a sense of what it is that the child is comprehending haptically, how this comprehension is sequentially ordered in development, and how this comprehension is functionally related to exploratory strategy.

The familiar objects consisted of a pair of scissors, a key, a comb, a pencil, a spoon, and the like. Cardboard cutouts were used for the geometric (euclidean) forms and topological shapes. Simple and symmetrical euclidean forms consisted of a circle, an ellipse, a square, a rectangle, a rhombus, a triangle, and a cross. More complex but still symmetrical items consisted of a star, a cross of Lorraine, a swastika, a simple semicircle, and a semicircle with notches along the chord. Trapezoids of various shapes were used as asymmetrical items with straight sides. The purely topological forms consisted of irregular surfaces pierced by one or two holes, open and closed rings, superimposed or intertwined rings, and the like.

Children below the age of two years six months could not attend to the demands of the task. Children up to three years six months were able only to recognize familiar objects–no form recognition–in the visual test situation. Children between three years six months and four years began to differentiate among the forms, but only the irregular, topological ones. For example, the distinctions were recognized between an open front and a closed figure, between a surface with one or two holes and one without holes, between a ring and a circle, and between intertwined rings and separate rings. No differentiation was made between the simplest euclidean forms. Haptic exploratory strategy was described as relatively passive. Grasping with both hands occurred, and responses appeared to be made on the basis of chance discoveries.

Children between four years and four years six months were observed to make the primitive euclidean differentiation between curvilinearity and rectilinearity; however, no distinctions within these dimensions were made. That is, the square remained undifferentiated from the rectangle and, likewise, the circle from the ellipse. Exploratory strategy was still found to appear global.

Between the ages of four years six months and five years, progressive differentiation occurred with regard to dimensions and angles. The square, rectangle, and triangle were not distinguished as readily as the circle was distinguished from the ellipse. Tactile-kinesthetic scanning revealed a search for specific clues with which to identify, rather than mere passive and global exploration. Between five years and five years six months the rhombus and the various trapeziums were recognized, although with considerable hesitation. Also, although with many errors, the star and cross were gradually differentiated. Haptic search was observed as being more active but not as yet wholly systematic.

Finally, commencing sometime in the sixth year (Piaget and Inhelder are rather nonspecific on this point) complex euclidean differentiations among the swastika, cross, and star were observed. Exploratory strategy at this stage became highly methodical. Finger tracings were systematic in that searching operations began at a point of origin and could be reversed.

For Piaget and Inhelder the perceptual activity in haptic exploration was a crucial requirement in the construction of a visual image for the recognition and reproduction test. At the stage of common object recognition, children needed only to make the match between the tactile-kinesthetic information and the already available visual image. Regarding topological differentiations, the children could have made their judgments on the basis of a single salient feature such as "open" versus "closed." The discovery of angularity, however, revealed an awareness of a salient feature but with a particular orientation to the form, that being a point of origin or an anchor from which exploration might proceed.

The basic units of perception are, for Piaget, termed "centrations" (Piaget, 1969). Perceptual activity reveals "decentrations" or connections between centrations. Decentrations are, in a sense, "filling in the gaps" between discrete percepts; however, this is not sufficient for an analysis of perceptual activity to account for image construction. Although decentrations ensure continuity in perceptual activity by conjoining adjacent centrations, what makes continuous scanning systematic? Piaget and Inhelder (1967) have indicated that the initial discovery of a point of origin coupled with the accumulation of decentrations from perceptual activity leads to the comparison of perceptual data—comparisons that take into account symmetry, opposition, juxtaposition, and proportionality. The result of this process is the systematic execution of operations that can be reversed and coordinated around one or more points of reference.

Soviet psychologists have conducted similar investigations into haptic perception. Zaporazhets (1965) has reviewed several Soviet studies on the development of haptic perception in the preschool-aged child. Like Piaget, Genevskaya found that methods of tactile-kinesthetic exploration improved with age. Hand movements of children three years to four years six months were neither systematic nor differentiated. Movements were playlike rather than exploratory. Blindfolded children would roll, push, pull, and knock the object placed in front of them. From four years six months to six years, children began palping the objects instead of using the more primitive executive and practical actions. Palping actions consisted primarily of a fixing character without exploration. This fixing behavior, it appears, would be sufficient to allow for topological recognition (Piaget and Inhelder, 1967). Children between six years and seven years six months were systematic in their palping movements, delicately tracing the outline of the objects (Piaget and Inhelder, 1967). As can be seen, both the age norms and sequence of haptic exploratory strategies bear striking resemblance to the discussion of Piaget and Inhelder's findings.

Further parallels can be found in the work of Zinchenko and Ruzskaya, also reported by Zaporazhets (1965). With the aid of sophisticated videorecording techniques, these investigators were able to observe with remarkable specificity the precise hand movements of preschool children. Genevskaya's results were replicated, but some more elaborate refinements are notable. Children were required to examine tactually a large, irregular figure behind a screen and, then, to recognize it visually when it was placed with other figures. Three-year-olds were observed placing the palm on the edge of the figure and pushing with the fingers while the palm remained motionless. Children between four and five years began actively using their palm and the surfaces of their fingers. Fingertips, however, remained virtually passive. Children between five and six years employed simultaneous touching of the object with two hands. Hand movements were coordinated in such a fashion as to either move toward or away from each other. Explorations were carefully meticulous, but no systematic tracing appeared. Rather, examination was restricted to a particular feature such as a hole or a protuberance without regard to its position relative to the whole figure. Only in six-year-old children was systematic tracing of the outline with the fingertips observed.

The effect of varying the mode of acquaintance (vision alone, tactile alone, vision with touching, and practical operation) was also investigated. Three-year-old children were more proficient in the subsequent visual recognition task under the touching-alone means of acquaintance than they were under the looking-alone condition. Looking and touching produced still fewer errors, and practical operation (inserting the forms in a form board) yielded the fewest. For children between four and six years, however, vision and touch means of acquaintance were reversed in error frequency. That is, these children were more proficient or made fewer errors on the visual recognition task when prior acquaintance was made in the vision-alone condition as opposed to the touching-alone condition. Between six and seven years, after systematic tracing of the fingertips was established, the error rate in all treatments approximated zero.

Zaporazhets (1965) concluded by citing evidence that haptic exploratory movements predetermine the oculo-motor movements of the eyes in the subsequent visual scanning of objects. Moreover, as active touch becomes less dominant in the information acquisition of children, the visual system takes on a more independent role and, accordingly, reveals a remarkably similar pattern of development as eye movements traverse the same course as do the haptic movements.

Thus, the importance of tactile-kinesthetic movements and haptic exploratory strategy appears basic to the integration of sensory information for purposes of coming to know the world. What remains to be established is the ways in which the apparent prepotency of haptic exploration can be exploited to aid in the education of deaf-blind children. First, however, the consequences of severe sensory impairment to normal development must be examined.

Consequences of Severe Sensory Impairment

Students of human sensation and perception have long recognized that the channels or sense modalities through which environmental information is initially and directly experienced are hierarchically ordered. If one considers visual, auditory, tactile-kinesthetic, olfactory, and gustatory sensation separately, one finds that each in turn at any discrete point in time provides decreasing amounts of information and, further, requires that the subject be increasingly more proximal to the external source of stimulation. In the natural world, however, it is not the case that humans employ sense modalities with their constituent organs and systems as separate and distinct channels of information input. J. J. Gibson (1966) has argued convincingly that the senses should be considered as perceptual systems that function in concert to actively obtain information from the environment. He describes the stereotype of the sensorially intact individual who actively interacts with his or her environment by extracting the distinctive features and invariant relations which contain information necessary for his or her survival and ultimate growth. This notion of cognitive development, with the specification of the mechanisms for perceptual learning and supporting data, has been expanded by E. J. Gibson (1969). This particular theoretical orientation is a fruitful source of pertinent information to those concerned with sensory impairment or dysfunction. Clearly, the view of the sensorially intact individual as a naturally efficient processor of information has vast implications for determining functional deficiencies in children born with an unintact sensorium.

An individual's efficiency in dealing with both novel and routine encounters with his or her other world depends on his or her capacity to scan the ambient environment, select pertinent stimulus information, filter out the irrelevancies, commit himself or herself to a plan of action, monitor the sequential execution of that plan (cybernetic feedback), and make the necessary corrections or adjustments in order to realize his or her goal.

Consider the individual with the loss or impairment of vision and hearing. These are the so-called distal senses because they provide direct information from remote external sources. They also allow for the simultaneous apprehension of greater quantities of information relative to the remaining modalities. Hence, the absence of either one or both imposes severe limitations on the individual in terms of the initial reception of information and the capacity to sensorially monitor behavior. This degree of relative inefficiency is even more striking when one considers the child who is born functionally blind with impaired hearing. For the congenitally, sensorially impaired child, the problem is further exacerbated by the absence of stored distal sensory information in his or her memory, a perceptual-cognitive base, against which to compare subsequent and immediate information in resolving the ambiguities posed by daily encounters with the environment.

The problem for special educators is indeed a complex one. It consists most generally of bringing the content of distal space to within the child's prehensile space. To accomplish this, one must determine the child's sequence of development or readiness to comprehend the particular aspects of the environment brought forth during intervention. With the absence of the distal senses, the primary mode of information input becomes the tactile-kinesthetic or what was described earlier as the haptic. One might conclude, therefore, that the severely sensorially impaired child's conception of objective space is developmentally slower in construction and would certainly depend on the integration of the remaining modalities with coordinated motor movements. How might information obtained haptically, then, direct the adaptive movements of the deaf-blind child in order that he or she may develop an efficient, cognitive awareness of his or her physical world? With the relevant preliminaries in normal child development outlined, and some of the difficulties imposed by multisensory impairment specified, some strategies for intervention can be examined.

Intervention Procedures with Environmental Coding

Students in special education programs at Teachers College, Columbia University, benefit greatly from the proximity of the many direct service organizations in the New York City area. The Mid-Atlantic Regional Center for Deaf-Blind Children located at the New York Institute for the Education of the Blind, the Rubella Birth Defects Project at Columbia-Roosevelt Hospital, the New York Institute Frampton Hall Program along with several day programs for deaf-blind and multihandicapped children provide valuable learning experiences for student teachers. These projects also serve as reminders of the university's responsibility to facilitate positive change. Recognizing the greater incidence of multiple impairments as well as increased residual vision in the population of children currently being served by the blindness system, Teachers College, through its Research and Demonstration Center for the Education of the Handicapped, has been developing a new focus on the solution of problems posed by low vision.

Although sight utilization has become the prevailing philosophy for educating the visually handicapped, specific methods, materials, and strategies for increasing the perceptual efficiency of vision have been developing slowly. Regarding psychomotor skills necessary for school-related learning, Barraga's (1964, 1970) approach has been the most widely disseminated; however, aside from this pioneering work, little else has appeared. Many of the so-called systems of perceptual-motor training developed by the field of learning disabilities, such as the approaches of Kephart (1971), Getman (1968), and Barsch (1968), show considerable promise. Whether or not these approaches directly affect the improvement of reading ability, they do increase general perceptual-motor efficiency. What has been lacking is an approach that would facilitate the development and improvement of visual-motor abilities in three-dimensional space, and one that would be amenable to children with multihandicaps.

Borrowing from modern information-processing theory and the Gibsons' differentiation theory of perceptual learning (J. J. Gibson, 1966; E. J. Gibson, 1969), environmental coding–an approach that is particularly appropriate for severe visual or attentional problems–is being developed at Teachers College (Jackson, 1972). According to differentiation theory, the environment is universally composed of a finite set of distinctive features and invariant relationships. The process of perceptual learning, throughout development, becomes one of progressively differentiating these environmental constancies by actively obtaining stimulus information.

Although one's awareness of a surface in relation to gravity (e.g., the ground upon which one sits) is maturationally determined by the appearance of the postural reflexes and the development of the vestibular system, the limits of space must be learned in some theoretically controversial manner. Limits may be drop-offs, obstacles, or walls. It follows that a visual impairment restricts the amount of information originating in distal space. For the blind, spatial limits must be heard by "facial vision" or touched either by the body or some instrument manipulated by the body. In visual obstacle detection the borders or edges of drop-offs, solid objects, or walls apparently contain the essential information for recognition. Therefore, by intensifying these relevant features in a teaching situation, one might expect a visually handicapped person to interpret distal space more efficiently. Also, since these features do exist in a far more subtle form in the natural environment, one might expect training in an exaggerated setting to transfer to the natural environment. To put it more simply, procedures for heightening distinctive elements and relationships should serve to cue the visually impaired individual as to "where to look" in open space. The most feasible way of selectively intensifying or coding features, elements, and relationships in a learning environment is to employ shortwave ultraviolet lighting.

Characteristics of Ultraviolet Settings for Environmental Coding

A room, a corralled enclosure, or some static spatial environment where the various parameters of lighting (e.g., direction, intensity, and hue) can be controlled and monitored may serve as a setting for environmental coding. The commercially available, ultraviolet fluorescent tubes (10, 20, or 40 watts), which are popularly known as "black lights," can be mounted on walls for table activities or on the ceiling for perceptual-motor activities. When fluorescent or ultraviolet reflecting materials are added to the environment, one is exposed to an intense sensory experience. The phenomenon experienced is such that the reflecting materials appear more intense than the original source of ultraviolet light. A major advantage of such an environment is that the teacher can select precisely those aspects of a visual space he or she desires to intensify. Thus, borders, edges, features, contours, and relationships in space can be artificially exaggerated by contrast with extraneous, irrelevant information ("noise") that is sensorially diminished.

As the notion of "heightened sensory awareness" has been made idiomatic by the so-called psychedelics, simulation of the psychedelic experience has met with considerable commercial success in the forms of "black light" posters, "dayglow" paints, fluorescent adhesive tapes, mineral oils, and body paints. It therefore follows logically that simulated, heightened sensory experience for the visually impaired may break, as it were, the sensory barriers posed by pathology in the visual system.

Environmental Coding with the Severely Handicapped Rubella Child

From birth to maturity an individual deals with the world on several levels. These may be called levels of cognitive abstraction or stages of information processing. They are sensation, perception, image representation, symbolization, and conceptualization (Mykelbust and Johnson, 1967). Sensation refers to the mere activation of sensorineural structures by impinging raw stimuli. Perception occurs when stimuli can be differentiated or discriminated from one another in the immediate sense. Distinctive features and invariant relations in the stimulus array acquire perceptual saliency (E. J. Gibson, 1969). Imagery or representation occurs when perceptions persist over time in the absence of their external source; e.g., when stimuli immediately perceived can be compared with percepts in memory. Symbolization occurs when a label or name is attached to the image or particular aspects of the images. The label or symbol becomes a means of summarizing information, thus allowing the operations of memory to be carried out more economically. Finally, conceptualization occupies the highest level of cognitive abstraction. This is required in problem-solving behavior or in the mental manipulation of hypothetical entities conceived in terms of deductive and predictive relationships. The appropriateness of ultraviolet lighting for environmental coding can be understood in terms of each of these levels.

Sensation

In an ultraviolet environment, those physical components or aspects that are not fluorescing remain dark. The overall effect on the retina is partial dark adaptation; therefore, peripheral vision is increased. Visual disorders with cataracts, central scotomas, corneal opacities, or a light-absorbing medium can benefit from a wider field of vision and distinct sources of light. Apparently, there is both peripheral and central stimulation as brightly colored features luminesce. Lateral inhibitory mechanisms and neurological feature detectors (Haber, 1973) are apparently facilitated in an ultraviolet environment. There is a sensorineural bias in human anatomy that allows for the recognition of borders and edges of visual stimuli. Evidently, contrast is best detected by the retina at the edges of objects. Higher up, in terms of brain function, lines are analyzed by the lateral geniculate body, and orientation is detected by on-off fields in area 17 of the visual cortex.

Assuming that a structural barrier is imposed by a visual disorder, visual information might be structured by means of simultaneous rod and cone stimulation, heightened contrast, and distinctive feature analysis to the degree that relevant visual information is received directly by the brain.

Perception

As advances are made in sensory psychology, more of the physiological mechanisms responsible for visual perception will become known. For the present, it remains appropriate to deal with perception behaviorally. Objects, therefore, become distinctive because they are acted upon. If one walks about an object, successive transformations of the object's various perspectives are experienced. Heightening the edges of objects would facilitate this very basic form of perceptual learning. In communication, for example, the face must become distinctive. Ultraviolet reflecting body paints can accomplish this by increasing the perceptual saliency of facial features.

Representation

Certainly many of one's daily visual encounters with the world are made easy by visual recognition. Incomplete or distorted information can be interpreted on the basis of stored visual images in memory. Perceptual activity in an ultraviolet environment can facilitate the formation of more accurate and complete images of the information that defines visual space. Thus, subsequent encounters with the real world might be more efficient if the individual with a severe visual impairment contained in his or her memory a store of features and relationships that could better structure incoming information.

Symbolization

One of the more recent and exciting contributions to knowledge about the acquisition of child language is the work of L. Bloom (1970, 1973). The beginnings of language that she describes simply reflect the child's attempt to express linguistically what the child is cognitively capable of understanding. The sensorimotor-level child speaks with "one word at a time" (L. Bloom, 1973), revealing the level of awareness (actions and relations) from which he or she operates. Not until object permanence has been established does the child complete syntax with the substantive forms of language. The similarity between L. Bloom's findings and Van Dijk's dramatic success with coactive movements has yet to be capitalized upon in developing a child language program for the rubella child. Van Dijk's remarkable insights into the levels of awareness and communication in severely sensory-deprived children suggest that the child will begin "talking about" those experiences he or she is cognitively ready to comprehend. L. Bloom's work indicates that this model applies to the normal child as well. The ultraviolet environment simply enhances the child's perceptual-cognitive space. The environment also can be arranged to focus the child's attention on a sequence of activities that will provide him or her with something to talk about.

Conceptualization

To discern the similarities, differences, and relational properties among things, they first must be attended to. This can be accomplished by the novel experience afforded by an ultraviolet environment. Whatever features or common elements the teacher wishes the child to concentrate upon can be made more salient with fluorescent materials. A clearer understanding of these levels and the advantages of environmental coding procedures will come from some specific applications related to the earlier discussion of normal developmental data.

Environmental Coding–Specific Applications for Sensorimotor Skills

Relying heavily upon the development of sensorimotor and perceptual-motor abilities in preschool level children discussed in an earlier section, several applications of environmental coding seem appropriate for the severely handicapped rubella child.

Body Image

Inadequate body image frequently has been observed among these children (Guldager, 1970). In an ultraviolet environment various parts of the child's body can be made to glow with body paints. The child may be conditioned to establish eye contact with the teacher. This is certainly a prerequisite for communication. Fluorescing facial features will engage the child, tangible reinforcement will sustain the child's attention, and varying facial expressions will evoke interest. From the initial discovery of the difference between "me" and "not me" to the differentiation of body parts by function, body coding can be an aid in the development of body image.

Hand Regard

Flicking is a frequently observed preoccupation with rubella children. It expresses a need for stimulation of a redundant and nonproductive character. In an ultraviolet environment the child's desire to gaze at light can be harnessed more adaptively if light can be emitted from an educational source. Earlier, the importance of the discovery of the hand in object prehension was described. When a white sock or glove is placed on the child's hand, the fluorescing glow is more stimulating than light radiating from the ultraviolet tube. Thus, the movement to which the child attends may reveal hand function.

Eye-Hand Coordination

The development of prehension analyzed by White (1971) can alert teachers to many strategies for improving sensorimotor skills in rubella children. Such things as mobiles, noise-making toys, and edges of containers can be made to fluoresce so that eye-hand function can be discovered. By careful attention to the sequence of prehension (swiping to placing responses), one could structure a teaching unit for overcoming sensorimotor deficits.

Environmental Coding–Specific Applications for Visual and Haptic Exploratory Strategies

Among young deaf-blind children one frequently observes that manual and visual exploratory strategies are functionally inadequate in the performance of developmentally appropriate tasks. A deficit or combination of deficits in the visual-motor area can account for much of the lag observed in the acquisition of self-help skills (eating, dressing, and general body care) and cognitive table tasks (matching and sorting). The ability to acquaint one's self with the world through smoothly coordinated and reversible finger-tracing tactics can be seen to develop as a result of two interacting factors: (1) the programmed proximo-distal maturation of manual movements (gross knocking with a palmar grasp to refined finger tracings); and (2) the inherent features and relations of objects in space. Thus, movements contact features, and features require alteration or extension of movements.

Retarded performance among young deaf-blind children may be the consequence of several factors: central nervous system disorder, general retarded mental development, experiential deprivation, and lack of sufficient sensory stimulation. One cannot realistically assume that any one or combination of these factors could be determined operative to the exclusion of the others in many severely handicapped children; however, providing these children with the most developmentally appropriate and propitious environment may allow considerably more skill to accrue.

Bimodal exaggeration of tactile-kinesthetic and visual features of objects that are presented in a Piaget-Inhelder sequence would hopefully facilitate the improvement of haptic and visual exploratory strategies and, in turn, recognition ability.

As was outlined in detail earlier, topological and euclidean feature analysis determines much of the visual and haptic exploratory movements of the preschool child. Coding such features and relationships in a sequence obtained by Piaget and Inhelder should facilitate the psychomotor efficiency of deaf-blind children.

Conclusion

Environmental coding procedures are being applied primarily to the severely low-visioned population; however, the use of ultraviolet lighting environments seems to have some particularly good advantages for the rubella child who has had substantial vision restored through cataract surgery. Particular aspects of the environment may be coded to the exclusion of others, thus aiding in the child's selective attention to relevant information. Another consideration is the portability of the equipment. One need only control the outside lighting to convert any setting to an ultraviolet environment. Modifications within the setting can be made easily. Thus, this approach is flexible enough to meet the individual needs and preferences of the teacher. Cost is not a concern because a light source and fluorescing materials can be purchased for less than $20.

One should mention that environmental coding is largely experimental, and that its further success will depend upon teaching outcomes in the field. As a final caution, there is no evidence of possible harmful effects from shortwave (visible) ultraviolet lighting; however, we know that the crystalline lens serves to filter out ultraviolet rays before they reach the retina. Considering that many rubella children are aphasic, some caution may be required even with the commercially available "black light."

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New Developments in Communication for Deaf-Blind People

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We often hear the argument "If we can go to the moon, why can't we develop better aids for physically impaired people?" Many have observed that rehabilitation is a technologically deprived area. The Southwest Research Institute is working to develop better communication methods for people who are both deaf and blind.

Southwest Research Institute is a nonprofit research and development organization owned by the people of Texas. It is a public trust, and no income is derived from taxes–local, state, or federal. All work is financed through research and development contracts with industry and governmental agencies. I am the manager of medical instrumentation research and mental habilitation engineering. Much of my work has been in the area of measuring blood flow, blood pressure, and parameters associated with cardiac function.

Design Approach

We have a contract with the National Aeronautics and Space Administration (NASA), Technology Utilization Division, to make aerospace-developed technology available to the educational and medical community. The physicians, psychologists, physiologists, engineers, and electronic technicians on our staff are cross-trained. We visit medical schools and rehabilitation organizations throughout the U.S. and talk with physicians, researchers, clinicians, educators, and physical therapists about their specific problems and we ask them where technological devices might contribute to the solution of these problems.

We are not trying to automate or mechanize the world. We want to help clinicians and educators to acquire the unique devices that they need. We begin by discussing the problem area and the specific problem with the special educator. Then we suggest solutions and hopefully arrive at a design approach. If warranted, we cooperatively prepare a proposal and seek funds for a development effort. This is an invitation to you to participate with us at Southwest Research in developing new devices for solution of the problems that you encounter in your work.

Technological Development

Requests have been received from many people for lighter braces and orthotic devices. We discovered, through the NASA Biomedical Applications Program, that better materials do exist. One such material is carbon fiber in an epoxy matrix. The carbon fibers are aligned in the same direction; this provides excellent strength characteristics. The weight is about one-third that of aluminum alloy. Before the carbon fiber material is cured, it is similar to flypaper and is easy to work. With NASA support we built a long-leg brace (Fig. 1). More than one-half the funding (about $30,000) was provided by the Internal Research Panel of Southwest Research Institute. The first person we fitted had a spinal cord injury; she was thin and could not manage the long heavy conventional braces. She used the new brace for several months and found that she could ambulate much better than with anything she had used previously.

We have developed a tiny transmitter to monitor the electrocardiogram, respiration, and temperature of infants for the study of sudden death syndrome; this is a joint project with the University of Texas. Another problem submitted to us on our NASA program concerned apnea. Infants on respirators sometimes die when the respirator clogs up. The nurse may hear the respirator working and think that the infant is breathing when the respirator lines may be stopped up with phlegm and other material. A thermistor, a heat-sensitive semiconductor device, is mounted in a fixture that is connected to the respirator lines. The air that the infant breathes in is cooler than the air that he or she breathes out. This change in temperature activates electronic circuits and causes a transmitter to deliver a signal to the nurse's station. The signal is proportional to and in rhythm with the infant's respiration. If everything is all right, the nurse will hear a whistle (or tone) in rhythm with the breathing. The nurse can observe when the rhythm changes and can obtain a gross indication of depth of respiration. If the tone becomes steady or disappears, the nurse knows it is time to see how the infant is doing. The complete apparatus includes a radio receiver, a transmitter, and a transducer. We did this work four or five years ago, and a commercial concern is about to produce the apparatus.

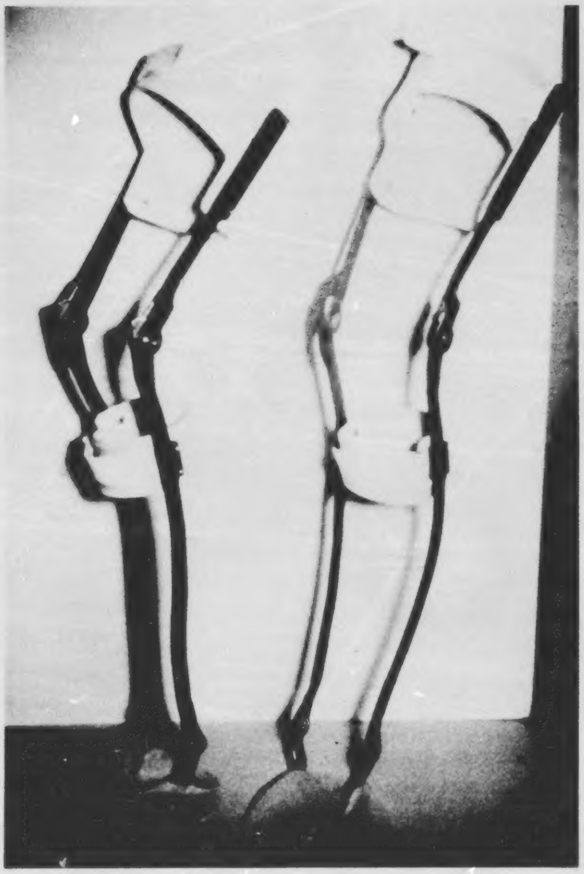

Fig. 1. Lightweight leg brace

Some institutions use electric shock to try and change behavior of self-injurious residents. We were told by people in an institution in Louisiana that commercial devices were not adequate and that they would "false trigger." You can imagine trying to do behavior modification with an apparatus that will accidentally deliver 90 to 100 volts on a random basis. We designed and built a very secure apparatus that is immune to virtually all radio-frequency interference. We were successful in overcoming the disadvantages of the commercial devices, and we built electrodes that would not "dig in" or cut the patient. We wore these electrodes ourselves for many days and received many shocks for test and evaluation purposes. This led us to conceive a way to prevent misuse of this device. Some sadistic people, who should not be working in institutions, have used this as a means for "getting even" with clients. I think we should build a dual unit so that the therapist will wear electrodes just like the client. When it becomes necessary to deliver an aversive stimulus, the therapist and the patient will receive the same aversive stimulus.

Some people who have had strokes have nerve damage, and the nerves and muscles that cause the toe of the foot to lift do not function. As a result they drag the toe, and, if they are debilitated or impaired in other ways, they cannot walk. Two flexible electrodes are mounted on the calf of the leg, one in the anticubital fossa or the fossa behind the knee and the other one down on the calf. A switch is mounted in the heel of the shoe so that, when a person moves to step off, the switch closes. This causes an electrical impulse to be delivered to the perineal nerve; the muscles contract and lift the toe of the foot. This apparatus may be useful in other types of physical therapy.

One psychologist has contended that athetoid children not only suffer from motor problems, but they suffer from lack of spatial and orientation feedback. This is one reason they make the so-called random, meaningless motions. They would make fewer random motions if they had a balance indicator that would let them know when their heads were upright. The psychologist designed and constructed a helmet, and we copied it. Five helmets have been loaned to various institutions. Each helmet, which contains mercury batteries and a level sensor, has a little beeper in it. Whenever the child leans to one side, switches close. This activates an oscillator, and the child hears a pleasant, nonalarming tone, which indicates that he or she is not sitting upright. The helmet has proved to be very useful at the University of Washington and in the Seattle area. Researchers found that cerebral palsied children with the helmet make fewer random motions, have better attention spans, and learn better in class. We loaned one helmet to a fifteen-year-old blind girl. She was not able to use a cane very well. She would lean to one side and would bump her head on door facings; she would sometimes fall. She used this helmet for about two weeks, and her walking posture improved tremendously. She did not want to give the helmet up even though it was a bit bizarre looking. For those who have a chronic need for such a sensor, a unit could be fabricated into a plastic hairpiece.

To identify real problems, the engineers at Southwest Research talk with clinicians, therapists, and special educators. They work with these individuals to arrive at a design approach, and they build an apparatus for laboratory and field testing.

We were asked by the Commission for the Deaf to build an apparatus to elicit the attention of deaf persons–particularly those who travel and have to stay at hotels. We built a very simple alarm system consisting of an accelerometer, an amplifier, and a vibrator (or strobe light). The accelerometer is secured to the door facing; a knock on the door initiates a signal that turns on the strobe light. For example, the strobe light can be used if a person is working at a desk or a vibrator can be set on a table. When initiated, the device bounces rather violently.

A special cane was designed and constructed for the Commission for the Blind. Members of the commission were considering building a complex and painting lines on the floor to have new cane users track the line. The cane worked well, but the commission abandoned the approach because it did not produce successful cane users. The cane had photocells, transmitter, receiver, and an acoustical output, so a black line could be tracked on a white surface even in the sunshine where light contrast is poor.

We also designed a light detector for the blind. The blind person who needs to know if an overhead light is on or the person who is working on an assembly line where things are coded "light or dark" can use this as a light indicator with an acoustical output.

Blind operators of vending stands often are cheated by people who give them a one-dollar-bill and tell them it is a larger denomination. It is embarrassing and time consuming to verify the denomination of every bill by asking another sighted person. Blind workers wish to be able to identify the denominations themselves. A paper money identifier (Fig. 2) was designed and produced under a NASA contract and with NASA technology. When the probe is moved over the bill, an acoustical output proportional to the light-dark pattern on the bill is generated. For instance, the five-dollar bill is easily identified because the Lincoln Memorial on the back "looks" like a picket fence; when you move the probe over the "pickets," a rhythmic and characteristic "bleep, bleep, bleep" is generated. After a few hours of training, the blind person is able to identify bills of from one to fifty dollars. This is a second-generation prototype that is presently under evaluation. A commercial concern on the West Coast is now building and marketing a hand-held, battery-operated unit. We are interested in commercialization because we want to see these devices made available to persons who need them at a cost they can afford.

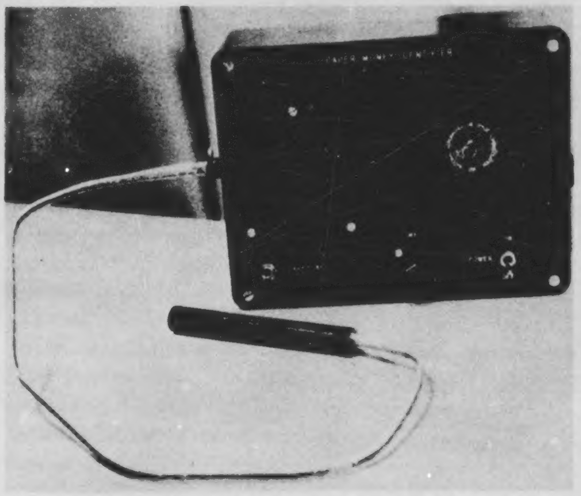

Fig. 2. Prototype paper money identifier

I would now like to discuss a couple of primitive and straightforward electromechanical approaches that may prove applicable to autistic children. I should emphasize that the things we are doing are in conjunction with the expressed needs of clinicians.

The candy machine shown in Fig. 3 may be applicable to a specific case of autism. A fourteen-year-old boy who lives in a dormitory with moderately retarded youngsters will not communicate with anyone. We decided to try an approach using a candy dispenser with a voice-operated switch. The candy machine will be mounted on a dormitory wall at some accessible spot. The children can obtain candy by pushing a button. After they have done this for two weeks or so, the button will be removed. Undoubtedly, the children will become angry; they may wreck the machine. But, in the place of the button, there will be a hole in the wall. A directional microphone with a voice-operated relay will be placed in this opening. Candy will be acquired by speaking into the hole; a "gah" will cause the candy machine to yield a piece of candy.

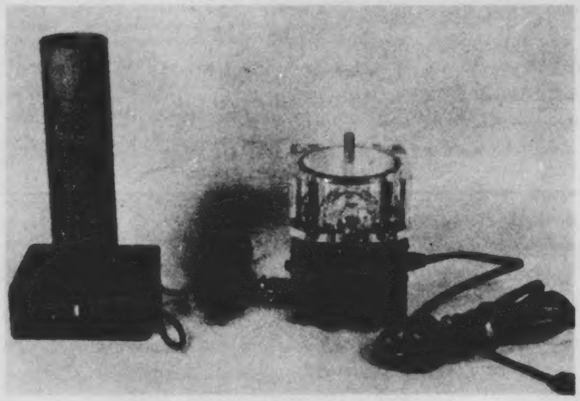

Fig. 3. Voice-operated candy machine

Psychologists on the staff of the National Children's Hospital in Washington, D.C., want to develop a communication system for deaf-blind children. They want a wireless, vibrotactile device that offers minimal encumbrance. The boxes in the lower right-hand corner of Fig. 4 are about 1 inch by 1 inch by 2 inches; they contain small vibrators. The boxes are off-balance-loaded so they will vibrate. Four of these vibrators are mounted on the shoulder blade and hip points in pockets of special jackets we have designed. The therapist or parent and the deaf-blind child have duplicate systems. The complete system consists of four switches, four vibrators, a radio receiver, and a radio transmitter.

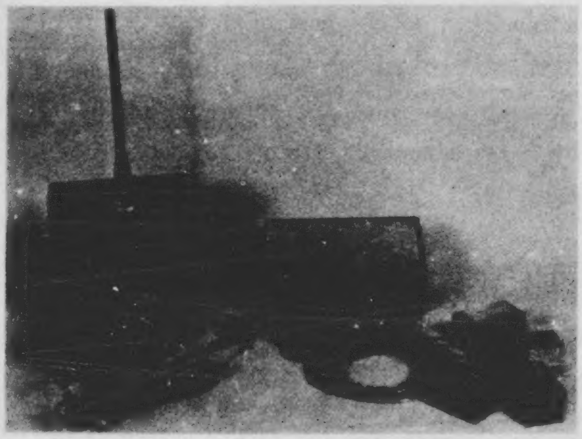

Fig. 4. Wireless four-point vibrotactile communicator for deaf-blind children

Paul Bach-y-Rita and others of Smith-Kettlewell Institute for the Visual Sciences have developed a vibrator. Also, they are developing vision substitution prostheses for profoundly blind people. When an AC voltage is applied to the solenoid, the plastic point vibrates. A system matrix of 100 vibrating points is shown in Fig. 5. A psychiatrist who is working with severely autistic children wants to use this system to develop a primitive or initial means of communicating with the children. When a button is pushed at one station, a point will vibrate at the other end of the line. The thought of this psychiatrist is that she may be able to induce nonverbal, autistic children to use this signaling apparatus for entertainment; then perhaps the children will begin to communicate vibrotactilely.

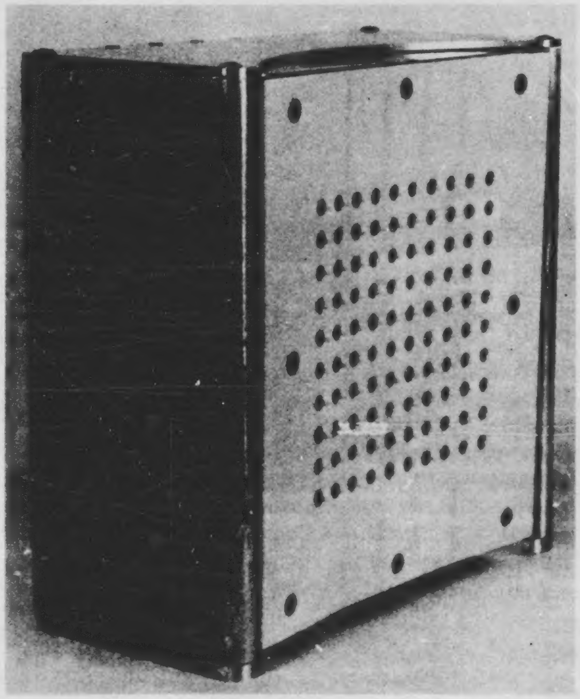

Fig. 5. Matrix of 100 vibrating points

A companion apparatus consisting of a matching matrix of lighted latching switches is shown in Fig. 6. When a switch is pushed, the corresponding vibrator is activated. The matrix of vibrators is mounted on the back, chest, or stomach, and one can send designs and letters tactilely. To deliver the letter E, one would depress the buttons that correspond to that letter and the person you are teaching would, if he or she is sighted, be able to see the letter in lights. The person would also be able to feel it tactilely. Dr. Bach-y-Rita activates such an apparatus with a television camera. A white spot is tracked on a dark screen, and the spot "walks" around tactilely on the child's skin. After a few minutes one can identify letters presented tactilely. It is our feeling at Southwest Research that this apparatus will not prove very useful until we can provide a programming capability that will enable us to present letters dynamically. That is, we need a capability for "writing" a letter on the skin so that it will appear sequentially as though someone is actually drawing the letter.

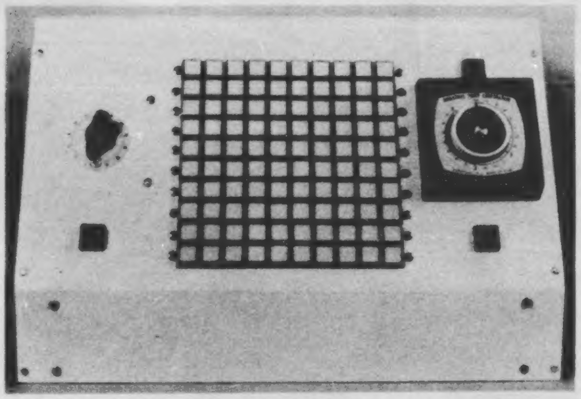

Fig. 6. Control console with 100 lighted, latching switches

Tactile Stimulation

Tactile stimulation for communication purposes can be achieved electrically, that is "electrotactilely." If we affix two electrical contacts to the skin and apply voltage in short pulses, such as 50 millionths of a second with 50 millionths of a second spacing, and deliver a train of seven or eight pulses repeated at a 20-cycle rate, we can elicit painless stimulation. The sensation is similar to a mechanical stimulus. Indeed, if we alternately supply a mechanical stimulus and an electrical stimulus, it is very difficult for a person to distinguish between the two. The electrical stimulation approach may prove to be the basis for good vision substitution prosthesis for profoundly blind people. The people at Smith-Kettlewell are fortunate in that they have a profoundly blind electronics technician who is assisting them in the development of such an apparatus. They have developed a 100-electrode matrix and an electronic package that weighs about 5 pounds. They use a television camera, a sort of a mosaic crawfish-eye camera, mounted on eyeglasses. The technician uses the apparatus as an effective mobility aid. Definition is good; he can differentiate between two people if one of them wears glasses.

But one serious disadvantage to this approach is that occasionally one receives an electrical shock and it is possible to even get tiny burns. The profoundly blind electronics technician at Smith-Kettlewell tolerates these experiences and uses this apparatus effectively. Dr. Geldard of Princeton University and others have serious doubts that we will overcome this disadvantage with the surface electrode. Nevertheless, a number of us throughout the country are continuing to work on this approach.

We are looking at other means of tactile stimulation. We felt that since we cannot overcome the problems and peculiarities presented by the surface of the skin, perhaps it would be a good idea to avoid the skin. So we have taken a surgical approach. That is, we surgically implanted two carbon electrodes in my arm. These protruded through the skin so we could run periodic electrical tests. Two incisions were made, the electrodes were implanted, and the posts were forced through the openings. As we predicted, the shock hazard was eliminated, less voltage and less power were required, and a more reliable threshold of stimulation was achieved. With surface electrodes, 90 volts are required for the threshold of stimulation. With the implanted electrodes, two-tenths of a volt is required and a very reliable threshold level exists. We repeated tests with these electrodes for seven months. The electrodes three weeks after implantation are shown in Fig. 7. The resistance or the impedance between the electrodes remained essentially constant. Infection occurred due to trauma, but the body did not reject the electrodes. I fell through a ceiling about three weeks after they were implanted and caught my arm on a 2 x 4. Even though an electrode was almost pulled out, the wound healed and the electrodes continued to function very nicely. In the future at least two electrodes and a coil will be implanted under the skin. The electromagnetic energy or stimulus will be delivered to the electrodes without breaking the skin. Indeed, this is being done at the present time to charge cardiac pacemakers. We know that we can deliver 20 watts of power through the skin; only ten millionths of a watt is required for this procedure.

A compression bandage is used to hold the contacts in place during the trial period to determine the best operating frequency, threshold level, and power requirements. A matching coil is placed under the wristband. The complete system includes a cigarette-package-size receiver and a radio transmitter. Communication is by means of international morse code.

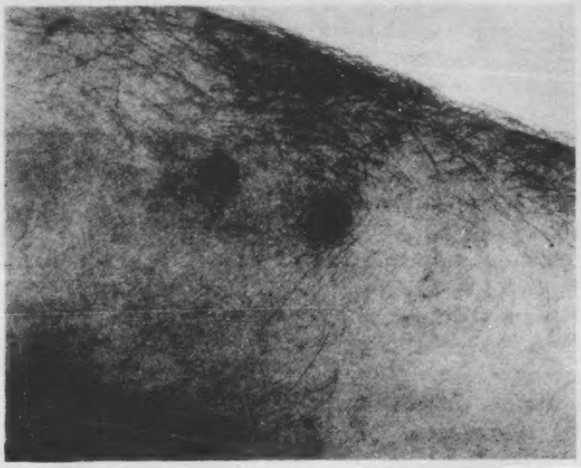

Fig. 7. Carbon electrodes surgically implanted in arm (three weeks after surgery)

Our designers have conceived a profoundly simple device that will not require the deaf-blind person to learn a new code. It is an artificial hand that will make all the signs of the one-hand manual alphabet (Fig. 8). Teletype tape and braille tape will be used to electronically control the mechanical hand. News stories could be received from the teletype machine and delivered to the deaf-blind person in a way that he or she understands. We have talked about this with the people at the National Deaf-Blind Center. They are doubtful and feel that this is a lukewarm idea. Nevertheless, the Ewing Halsell Foundation in San Antonio has provided funds and we have begun design and development of the Laenger Hand. The big question is, of course, will it be useful and will it be accepted by deaf-blind people? Before we turn the first screw or solder the first wire, we will hire three deaf-blind consultants to participate in the designing and testing. These individuals will be involved in the development of a new apparatus for their own benefit. We will first explain to them what we are trying to do. As we buy electronics parts, nuts, bolts, and screws, we are going to let these deaf-blind consultants feel them. They will examine the prototype device in all phases of development and, when one finger becomes articulated, they will be present to test it out. When the artificial hand is born, it will not be a stranger to them. Indeed, these deaf-blind consultants will be ego-involved and they will want it to work.

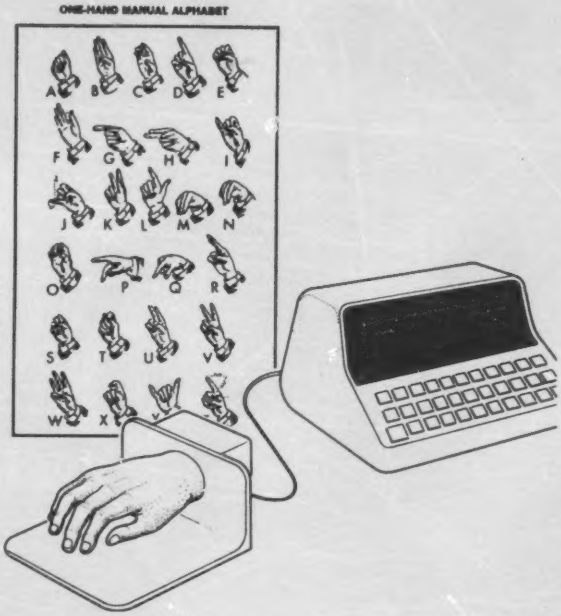

Fig. 8. Artificial hand for communicating with deaf-blind individuals

Conclusion

Southwest Research Institute designers are interested in hearing about any technical problems encountered in the education of the deaf-blind. Our mission is to provide innovative technical devices that are needed for developing new methods of teaching and training physically and mentally impaired individuals.

Aids and Appliances for Employment and Rehabilitation of Blind and Deaf-Blind Individuals

George F. Dalrymple, Acting Director
Sensory Aid Evaluation and Development Center
Massachusetts Institute of Technology

Those who work in the field of aids for the blind see many examples of blind persons functioning as highly productive individuals. They work as computer programmers, Internal Revenue Service taxpayer service representatives, dispatchers, telephone answering service operators, court room stenographers, typists, dark room equipment operators, lawyers, disc jockeys, Veterans Administration service representatives, and the like. To hold any of these jobs, the blind person needs to have the desire to be a fully functioning member of society and the appropriate help or training.

Although most of us know of many deaf or blind individuals who are employed as any "normal" person is employed, most of us know few deaf-blind individuals. These individuals, with few exceptions, were (and many still are) relegated to the "back room" in both our national social conscience and in actuality. This is perhaps due to the difficulty that an "average" person has in communicating with a deaf-blind individual. The average person can communicate with a blind person or a deaf person through regular channels of communication, perhaps with only a slight change from the regular ways of communicating.

To help the deaf-blind overcome their communication deficit, equipment and techniques have been developed to enable them to communicate. Because this report is by a technologist, only methods of communication that rely on equipment are considered.

Braille

Braille is a product of modern technology that has created tools and devices to help the blind and deaf-blind become competitive in the everyday world (Fig. 1).

Manual Braille

The Perkins braillewriter is the machine most commonly used for writing braille. It is used by people in all walks of life. The braillewriter is generally considered invaluable by blind students.

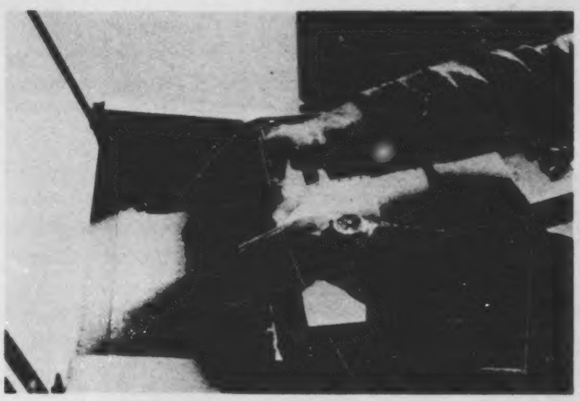

Fig. 1. Reading braille

Braille Terminals

Braille is generally produced manually by volunteer workers or by modified printing presses with zinc plates prepared on stereotype. Since remote terminals with braille-producing devices equivalent to a teletype are available, braille can be translated via computer (Fig. 2). These terminals make remote time-shared computers available to the blind or deaf-blind in a way that they can be competitive with the sighted in the job market.

The Braillemboss exists in two basic models. The Model 3 system (Fig. 3) is designed to emboss braille for subsequent use in books, pamphlets, and similar materials. The Model 4 system (Fig. 4) is arranged for interactive computer use; i.e., the blind person uses the computer in a time-sharing mode. The individual must be able to read the computer response to his or her input material to help determine the next input material or command to the computer.

Fig. 2. Janet Field and computer-translated Grade II braille

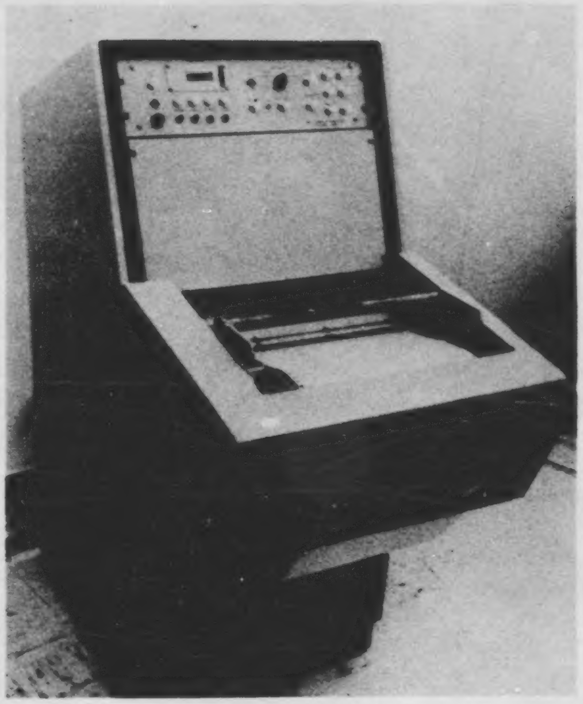

Fig. 4. Model 4 Braillemboss

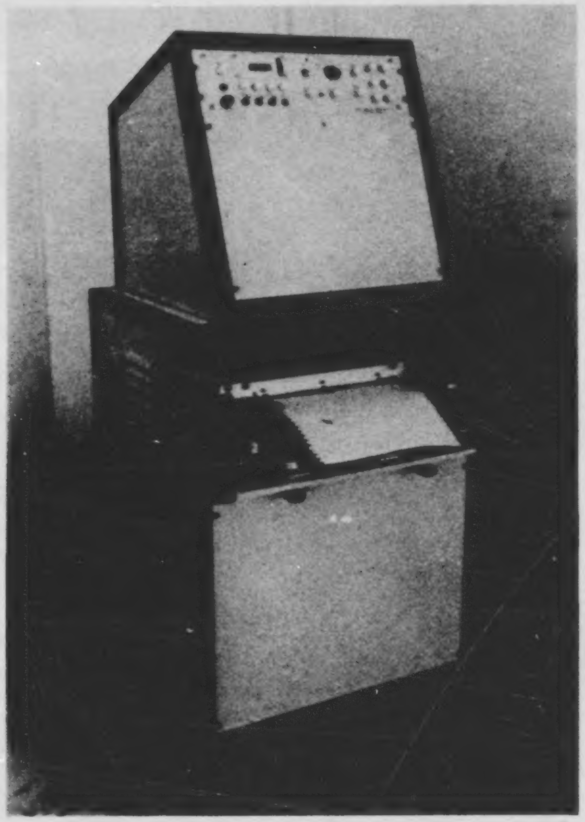

Fig. 3. Model 3 Braillemboss

Fig. 5. John Morrison at work using a Braillemboss

The first Braillemboss was installed in the office of John Morrison of the Transportation Research Center of the Massachusetts State Department of Transportation (Fig. 5). Dr. Morrison's experiences with the Braillemboss are best summarized by a report he wrote after three months of use. His report is as follows:

> I have been involved in this type of work (the application of orbital mechanics to the determination of the motion of earth satellite) for ten years. By the nature of the work, it has been essential to program the results of my research on a computer for purposes of verification of the accuracy of the calculations, evaluation of the method employed, and investigation of possible applications. As is not unusual, I have called in programmers to carry out the actual programming and

running of the results on a computer. I have had to rely on others to at least scan the numerical output in order to keep abreast of progress. The whole procedure has been quite unsatisfactory. The effort, time, cost, red tape, and the inefficiency of the procedures have led, in practice, to laying aside possibly fruitful avenues for investigation.

With the advent of time-sharing capability, the situation has been completely altered. A scientist can now have direct access to the computer and almost zero turn-around time. However, for a blind scientist the time-sharing capability of computers is absolutely useless without a braille output device to reproduce the teletype output. It was my good fortune that, when the time-sharing facility became available to me, almost simultaneously the Massachusetts Institute of Technology (MIT) Braillemboss was put at my disposal for evaluation purposes.

From a purely personal point of view, I cannot emphasize enough the almost unanticipated boost in morale the Braillemboss has afforded me. For the first time, I can assess the computer directly and, for the first time, I can read the results of my labor. It is no exaggeration for me to say that, for the past three months, I have spent just about every waking moment either sitting at the Braillemboss and teletypewriter or preparing my next numerical experiment. Needless to say, I have not exhausted the backlog, built up during the past ten years, of possible uses for the computer.

From the point of view of a productive worker, my contribution to the in-house effort has kept pace with my colleagues. This would not have been the case had I not had the Braillemboss at my disposal. I consider it an indispensable instrument for my work. Should I be deprived of its use, my value to my employer would suffer commensurately.

In my opinion, every possible effort should be made to ensure the development and further refinement of the MIT Braillemboss and its availability to all blind persons who can demonstrate a legitimate use for it. The potential uses for the Braillemboss are by no means limited to my particular applications. The least that can be said is that whatever is available to a sighted person through a teletypewriter is available to a blind person through the addition of a Braillemboss. This capability alone is sufficient to justify the development of the Braillemboss.

Four years later his attitude toward the usefulness of the Braillemboss has, if anything, intensified.

Some MIT students have used the Braillemboss as part of their academic work. One student, Mike Lichenstein, was able to perform the computer simulation required for his thesis independent of sighted help (Fig. 6). Another student who used the Braillemboss is Alan Downing (Fig. 7). He was able to use the computer. As a systems programmer for a large computer manufacturer, he still uses the Braillemboss.

Braille terminals can help the blind work in various occupations (Fig. 8). Braille terminals also make jobs feasible wherever a person has to communicate with the public by telephone. Newsbroadcasting now is accessible to the blind. One individual receives the news in braille and reads it on camera (Fig. 9).

Other devices are available, chiefly from Triformation Systems, Inc., Stewart, Florida. These devices include the BD3 strip printer and the LED-120 line printer.

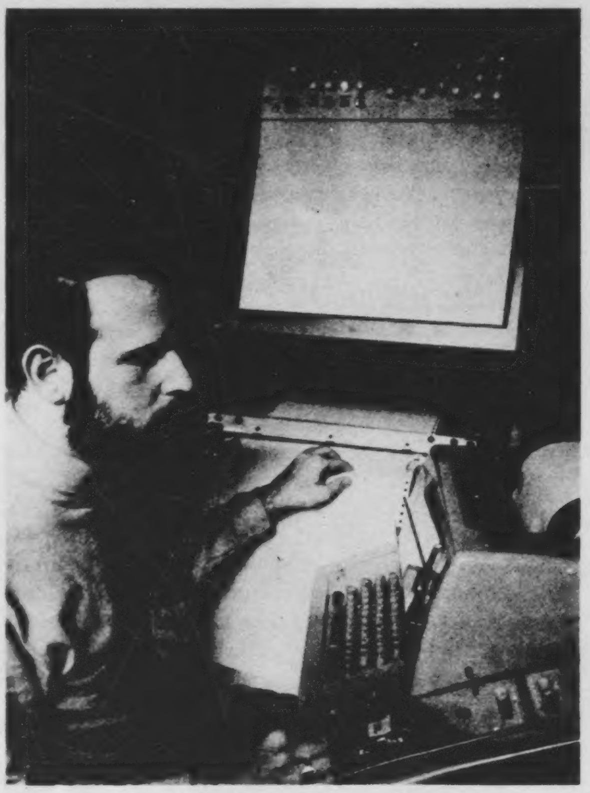

Fig. 6. Michael Lichenstein using Braillemboss in his doctoral studies

One-on-One Braille

Braille also can be used as a one-on-one tool for personal communication with a deaf-blind individual. The American Foundation for the Blind makes the Tellatouch, which is a manual device that enables a person to communicate with a deaf-blind person who knows braille. The sender communicates via a standard typewriter keyboard.

Fig. 7. Alan Downing using a time-shared computer in his work

Beneath the keyboard is a space bar on both sides of which are three blank keys. Each of these keys corresponds to a dot in the braille cell. At the back of this device is a metal plate with six holes in the shape of a braille cell. The deaf-blind person places a finger on this braille cell. The sender presses a key, causing the corresponding braille letter to be raised in the cell. When the typewriter keyboard is used, only Grade I braille is transmitted. To send contracted braille, the sender must be familiar with the contractions and use of the six keys below the alphabetical keys. The deaf-blind user of the Tellatouch can send messages only to persons who know braille. The device is 9 inches square and weighs about 3½ pounds.

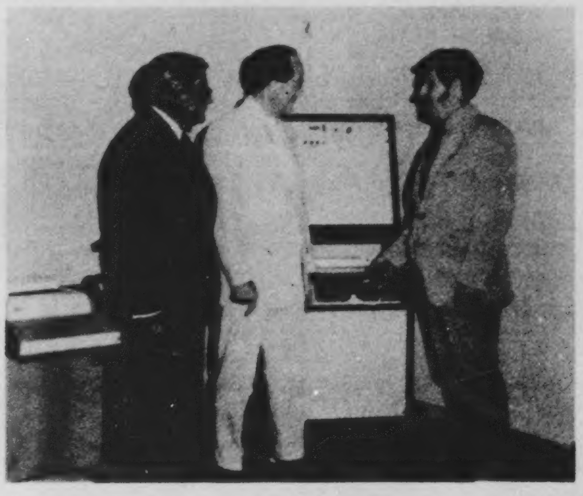

Fig. 8. Jack McSpadden, an IRS taxpayer service representative, demonstrating his Braillemboss

A similar device is the Arcaid, which is manufactured by the Royal National Institute for the Blind. This device is smaller than a portable typewriter and consists of a typewriter keyboard and a braille printing device. Paper tape is used for braille printing. The typewriter keys are depressed, causing the appropriate braille letter to be embossed on the tape. A permanent record of a conversation can be made by the deaf-blind person.

The designer claims that no special skills are needed to use this machine. A typist can use it to transcribe braille at high speed. On each side of the

Fig. 9. Paul Caputo reading Braillemboss-generated newswire braille

keyboard are three keys like those on a Perkins braillewriter. These can be used to print Grade I or contracted braille.

The Telebraille is a device that is a remote telecommunication version of the Tellatouch but with only the six dot keys and a space bar. The Telebraille allows the deaf-blind person to communicate over the telephone by braille; however, the design does not employ punched or embossed type (which can make telephone communication awkward and/or expensive because of the need for maintenance and replenishment of materials). Instead, the design provides for the "listener" to read the message from a single braille cell similar to that on the Tellatouch, while the "speaker" sends braille. The Telebraille is still in the prototype stage.

To send a message, the user presses keys on a keyboard similar to that on a Perkins braillewriter. The braille characters then are converted into corresponding audiofrequency-shifted binary strings that are acoustically coupled to a telephone handset. On the receiving end the handset is acoustically coupled to an identical unit that converts the binary strings to signals that drive pins in the braille cell. The Tellatouch is essentially split in half, and modern electronic digital transmission techniques are substituted for the mechanical linkages of the Tellatouch. Moreover, both Grade I and contracted braille can be transmitted via the Telebraille.

Plans provide for the future availability of a standard typewriter-type keyboard so that persons not familiar with braille would be able to communicate with deaf-blind individuals. As in the Tellatouch system, a letter would be pressed on the keyboard, and the appropriate braille character would be transmitted. Only Grade I or modified contracted braille could be sent by this adaptation. Future plans also call for: (1) an attachment that would provide the teletypewriter input or output so that deaf-blind persons could converse with seeing deaf persons or anyone who can read braille, speak, or read print; and (2) a "talk-back" provision that would enable a speaking deaf-blind person to verbally respond to a hearing person.

A device similar to the Telebraille, the Braillophone, is produced in Germany. The Braillophone embosses strip braille instead of providing a single solenoid-operated braille cell. This device primarily has been used as a teaching machine, but it also can be used as a telecommunications tool for the deaf-blind.

One-on-One Communication Devices

Three simple devices for one-on-one communication between a deaf-blind person and someone who does not know the manual alphabet are the alphabet plate, braille alphabet card, and the alphabet glove.

The alphabet plate is a 4-inch-by-6 ⅜-inch lightweight plate made of an aluminum alloy. On it, in alphabetical order, are large, embossed print letters arranged in three rows with a fourth row of raised numbers. The sighted person places the deaf-blind person's index finger on each letter as words are spelled out. If the deaf-blind individual has no speech, he or she can reply by pointing to the letters as well.

The braille alphabet card is similar to the alphabet plate, but, as its name implies, it is embossed with the braille alphabet. Print letters are above each braille character. The deaf-blind person's index finger is placed on each letter to form words. He or she can answer both blind and sighted persons by pointing to the appropriate letters. This card can also be made at almost no cost by anyone who knows braille.

The alphabet glove is a regular glove of thin fabric upon which are printed (in indelible ink) the letters of the alphabet. It is generally a homemade device. The letters are on the palm side of the glove, along the tips, joints, and base of each of the five fingers. Numerals from zero to nine are placed on the back of the glove on the fingernails and joints. While the deaf-blind person wears the glove on one hand, the individual with whom he or she is communicating touches the appropriate letter or number on the glove to form words. The deaf-blind person memorizes the position of the letters and numerals and, through practice, can use this method of communication quite rapidly. Of course, because of the differences in hand sizes, gloves must be individually marked for each user. It has been found that family and close friends soon memorize the position of the letters so that they can communicate without the deaf-blind person wearing the glove.

Paging and Remote Alerting Devices

Several systems have been proposed for wireless communication with the deaf-blind. Two that have been reduced to practice are the Bell and Howell vibration paging system and the MIT Taccom system. Basically they are paging systems with a vibratory indication. The Taccom device has a signal bandwidth on which morse code or other on-off signaling can be used while the Bell and Howell device has only a fixed-duration signal.

The Taccom system consists of a cigarette-package-sized receiver that is worn in a shirt pocket or in a holster on a belt or chain (Fig. 10). It vibrates when it receives a signal from the transmitter (Fig. 11). The fixed-station system requires large loops, essentially enclosing the covered area, connected to the transmitter.

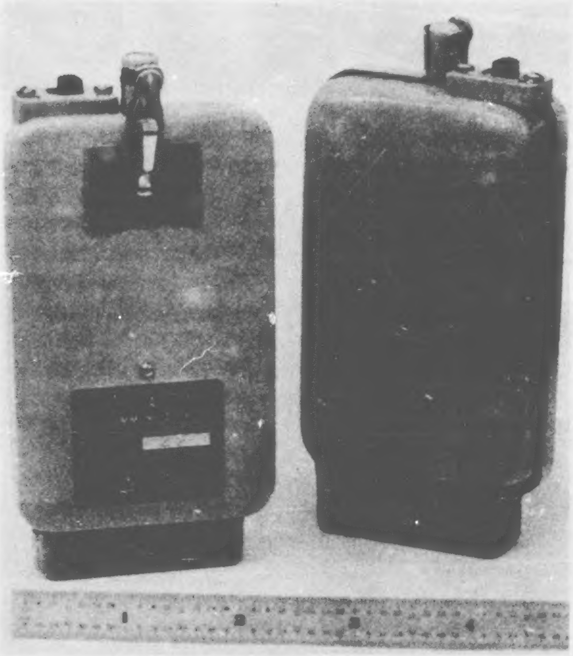

Fig. 10. Taccom receiver (front and rear views)

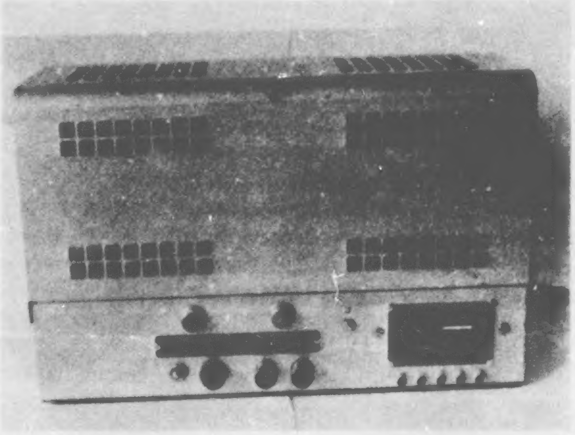

Fig. 11. Taccom fixed-station transmitter

A Taccom system is being used at the National Center for the Deaf-Blind. It is used to signal the beginning and end of the class periods. This signal causes a vibration of the receiver for 2 or 3 seconds. The Taccom is also used as a fire alarm system. This signal causes a continuous on-off sequence of vibrations that are very difficult to ignore.

The Taccom device also exists in simple short-range systems that can be used for training or similar applications (Fig. 12). The range of the portable transmitter is about 3 to 6 feet (Figs. 13 through 15).

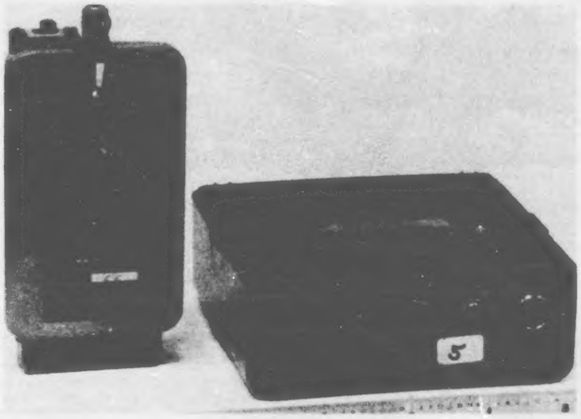

Fig. 12. Taccom hand sender and receiver

Reading Machines

The reading speeds achieved by a good braille reader testify to the effectiveness of the tactile sense as an input channel. Braille reading speeds are enhanced by the use of simplified six-point symbols and contractions that eliminate much of the redundancy contained in printed characters and printed text; however, the automatic translation from print into braille requires a complex processing system, including a multifont character-recognition capability, which cannot yet be made portable at low cost. Technically simpler and potentially cheaper devices that produce facsimile displays of optical characters, either tactilely or auditorily, can be built in compact form. Several such direct-translation reading aids are currently being developed and tested.

Several devices have been developed under Veterans Administration sponsorship. The Visotoner contains a vertical column of nine photocells, an optical system, and the electronic circuits to

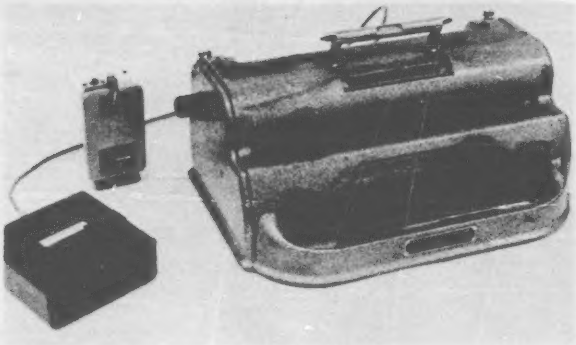

Fig. 13. Perkins braillewriter with Taccom end-of-line indicator (front view)

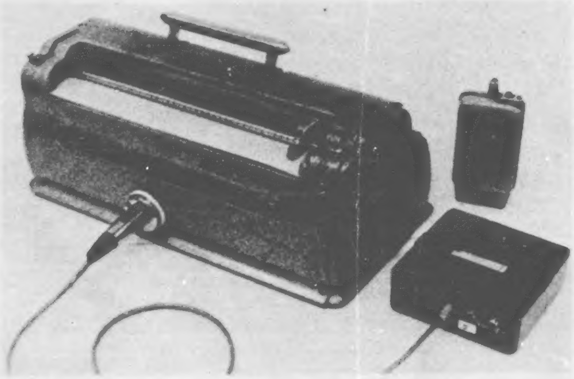

Fig. 14. Perkins braillewriter with Taccom end-of-line indicator (side view)

Fig. 15. Vito Proscia demonstrating Taccom end-of-line indicator

generate a different audible tone for each photocell while it is "seeing black."

One should not say that the machine reads; rather, it presents the letter shapes as tone patterns. As the machine is moved along a line of print, the nine-tone output is usually heard in an earphone. Each letter has its characteristic tone pattern. If the two lowest tones are heard, it means that the letter extends below the line. Each of the five middle tones responds to its assigned band of print encompassing the so-called "x" height of the letters. If the highest tones sound, this means there is print extending above the "x" height. For example, reading a hyphen results in a steady tone. The letter "I" consists largely of a chord, and the letter "V" makes a "wavy" sound.

The user must learn to interpret these tonal patterns as letters and words on the printed page. This involves a rather lengthy learning process similar to the experience of a sighted child learning to read inkprint. A 200-hour course of training includes a text in ordinary print and some tape recordings.

The Visotoner has a variable-magnification optical system that permits the user to select the proper magnification for reading letters printed in 7- to 36-point type. A lamp brightness control is also used. The machine with its battery and earphone can be carried in its leather case, which is the size of a hardcover book. During training and when reading for long periods, one should use the machine with a tracking board, the Colineator. All the required equipment for the Visotoner plus the Colineator, a battery charger, and spare battery, fits into a small, specially designed attache case.

A tactile version of the Visotoner is the Visotactor (Fig. 16). It uses the same hand-held-and-guided optical scanner as the Visotoner, but it also contains eight tactile stimulators (two per finger) and eight photocells. A control enables the user to adjust probes/optical magnification for size of type (7 to 26 point).

The Cognodictor uses an optical probe similar to the Visotoner and Visotactor but with an additional number of sensing elements (Fig. 17). It also contains character recognition equipment so that spelled speech can be used. This relieves the user of the necessity to learn strange sounds. A similar device, at least in concept, is the Lexiphone (Fig. 18), which is being developed at the University of British Columbia.

All of the above devices have been built in small quantities and have been used by small numbers of people. These direct-translation systems, in which

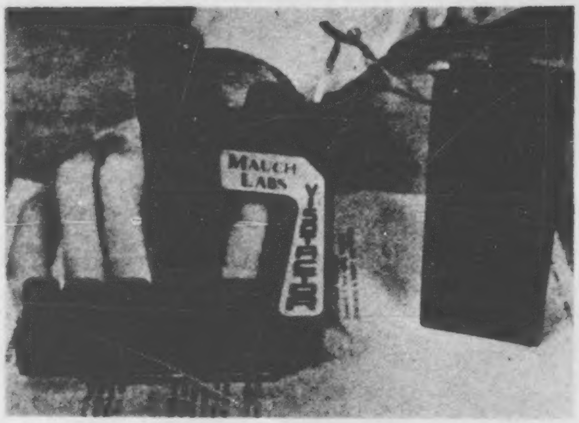

Fig. 16. The Visotactor, a direct translation reading machine with eight stimulators (two per finger) built into the optical probe

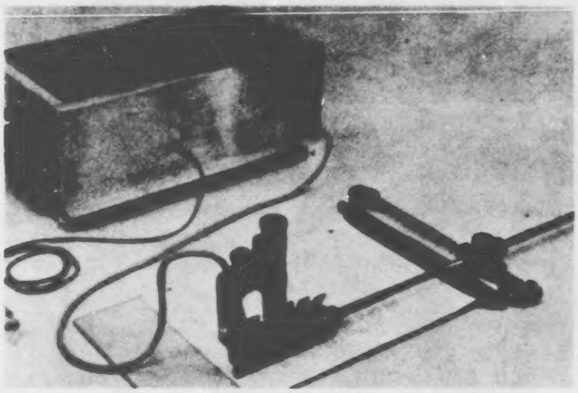

Fig. 17. The Cognodictor, a recognition reading machine with spelled speech output

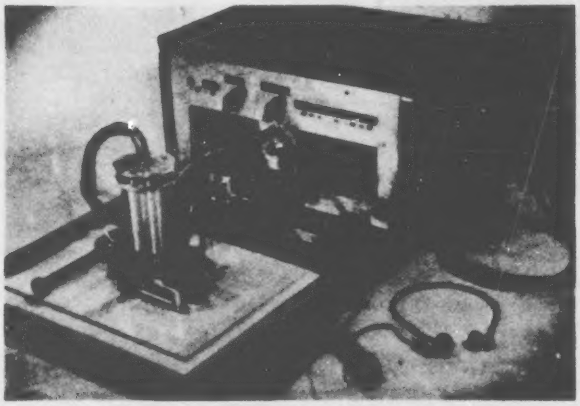

Fig. 18. The Lexiphone, a direct translation reading machine with audible nonspeech output

the user translates vibrating pins or modulated sounds into perceived print, result in reading speeds that are too low to be usable except in a few restricted cases. The character-recognition devices are still being developed; however, two direct-translation reading machines are now available. They offer higher reading speeds, one audible and one tactile. The audible output device is the Mauch Laboratories Sterotoner with a dual-column optical probe. Each ear receives the data from a separate column. These units have been made available through the Veterans Administration.

The most successful direct-translation reading machine is the Optacon (Fig. 19) developed at Stanford University and Stanford Research Institute and manufactured by Telesensory Systems, Inc. It is now being used by up to 500 blind people. Persons have achieved reading rates ranging from 20 to 90 words per minute with the Optacon. Most feel that it is very useful to them, especially for reading correspondence, magazines, some books, the dictionary, and educational materials. This machine can also be used for typing.

The Optacon translates an area on the printed page about the size of a letter space into a facsimile tactile image. This tactile image is produced by a 24-by-6 array of small rods driven by piezoelectric reeds. The entire array fits on a single finger. The reader senses the tactile image with a fingertip of one hand while moving a small optical pickup probe across the line of print with the other hand. This probe contains a monolithic silicon integrated array of 144 phototransistors and an optical system capable of changing magnification over a 2.5 to 1 range. The complete Optacon weighs about 8 pounds.

Because the process of learning to read with the Optacon requires a significant amount of training and practice, some consideration has been given to the development of equipment to assist the student. An electronic system that enables signals recorded by an ordinary audiotape recorder to produce moving alphabetic images on an Optacon has been developed. This unit is used to teach tactile image perception without hand tracking and to increase reading speed by forced pacing.

Electronic Mobility Aids

During the past 25 years over 20 guidance devices for the blind have been built. These have been based on a variety of principles and have been aimed at the solution of various aspects of the travel problem. There are at least three currently active research and development programs on guidance devices. While there have been some guidance devices built that operate on ambient light reflected from the obstacle, all three active programs are primarily concerned with systems that radiate either electromagnetic or acoustic energy.

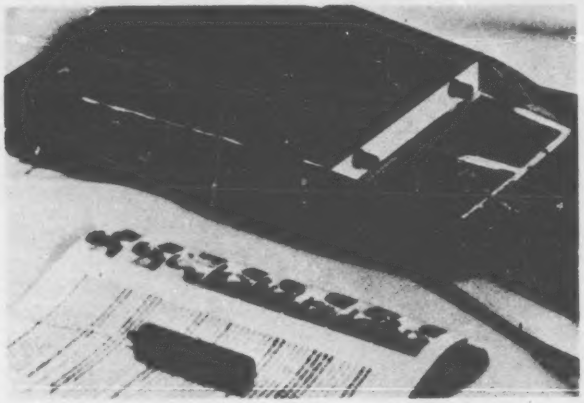

Fig. 19. The Optacon, a direct translation reading machine with 24 x 6 array of tactile stimulators

For the past 21 years Haverford College and Bionic Instruments, Inc., have been engaged in the development of an electronic travel aid. The major device currently under development and testing is a laser cane or bionic cane (Fig. 20). This device has had several predecessors which, while marginally useful, have led to the current design philosophy; i.e., to apply integrated circuit technology to expand the usefulness of an existing mobility aid. Thus, the triangulation ranging technique, which was developed in earlier devices, was combined with the Hoover long cane (Fig. 21). This research has led to the present design, and ten devices are being tested.

The bionic cane combines three lasers, associated photocells, and electronic systems into three optical ranging systems. One laser beam is responsible for detecting objects ahead of the individual and is intended to permit relaxed walking without fear of hitting obstacles or striking people's legs. It also has an adjustable ranging feature for the detection of more distant objects which may represent significant landmarks useful in navigation. The second laser beam projects forward and downward ahead of the cane tip to provide assurance of an extended level walking surface. The third laser beam points upward to detect overhanging branches, signs, casement windows, or other above-the-waist hazards.

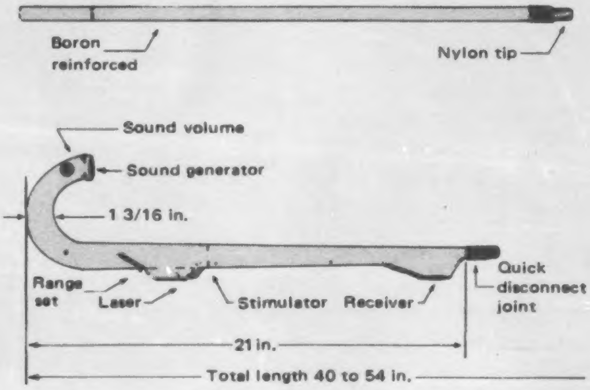

Fig. 20. Laser cane

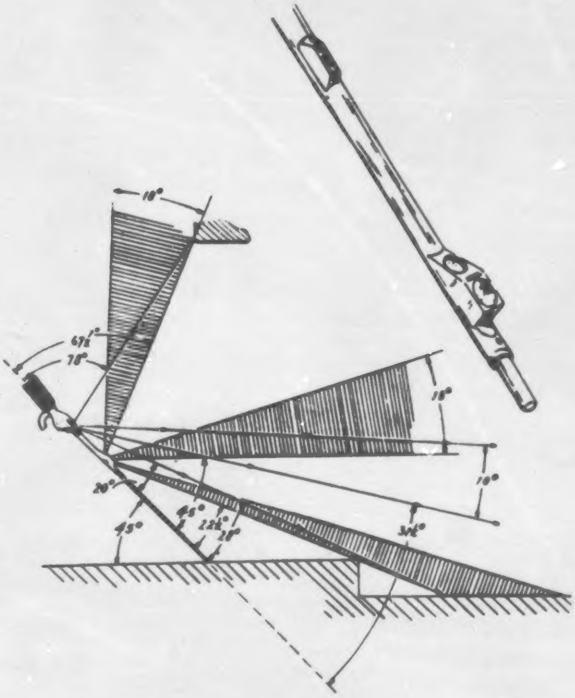

Fig. 21. Laser cane, range triangulation schematic

Some early concern over the possible danger of the lasers to sighted bystanders has now been dispelled, and it is to be hoped that the current tests will prove this long-awaited development to be at the point of practical utility.

A second currently active guidance device program is the one originally pursued by Kay at the University of Canterbury, New Zealand. A more technically refined version is now being developed by Wormald-Vigilant Limited in New Zealand. A training program also is being developed by Rowell.

The binaural sensory aid is based upon an ultrasonic sonar system (Figs. 22 and 23). The system uses two independent receiving channels with a frequency-modulated transmitter radiating into a 50-degree solid angle. The output signals are directed to the user binaurally, the purpose being to indicate both the distance and direction of an object simultaneously over a wide arc of "view." The transmitter and receivers are built into a pair of spectacles to provide an attractive and convenient way of mounting the device on the user.

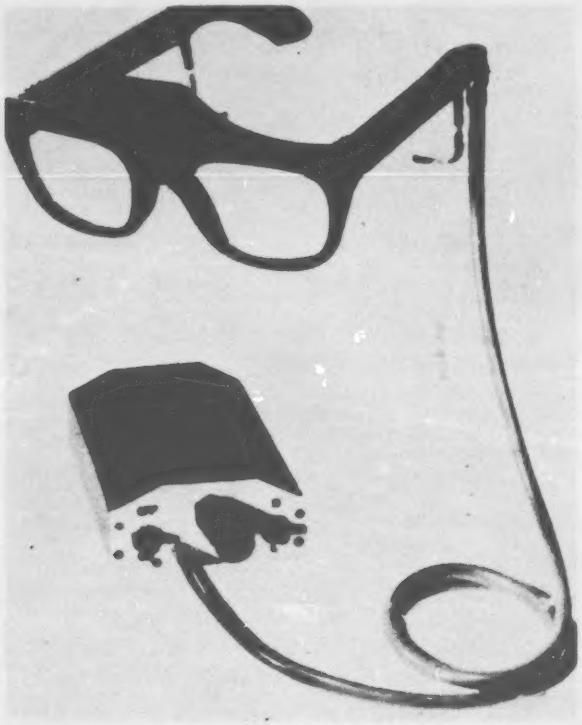

Fig. 22. Mark IA binaural sensory aid

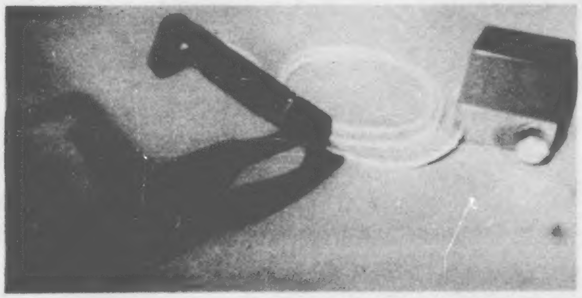

Fig. 23. Mark II binaural sensory aid

In operation the ultrasonic spectacles transmit a beam of energy, which sweeps from about 0 to 45 kHz in the course of a short pulse. The received echo is mixed with the transmitted signal and the resulting difference-frequency signal is conveyed to the user through earphones. For reflection from a stationary object the difference frequency is constant and proportional to the range of the reflecting object. The amplitude of the displayed signal is a function of the reflecting properties of the object as well as its distance; hence, the relative intensity of the signals reaching the two ears and the time of arrival indicate the direction of the reflecting object. The complex array of objects present in the typical environment leads to the generation of a similarly complex audio pattern. The designer of this device is assuming that the user, with proper training, will learn to distinguish the important from the irrelevant information. Only careful evaluation can determine whether this assumption has any validity.

A third currently active guidance device program is based on a device developed by Russell in conjunction with the Massachusetts Institute of Technology's Sensory Aids Evaluation and Development Center. This device is called a Travel Pathsounder (Fig. 24). It is worn around the neck and hangs at chest level (Figs. 25 and 26). The display is auditory and is effected by two small

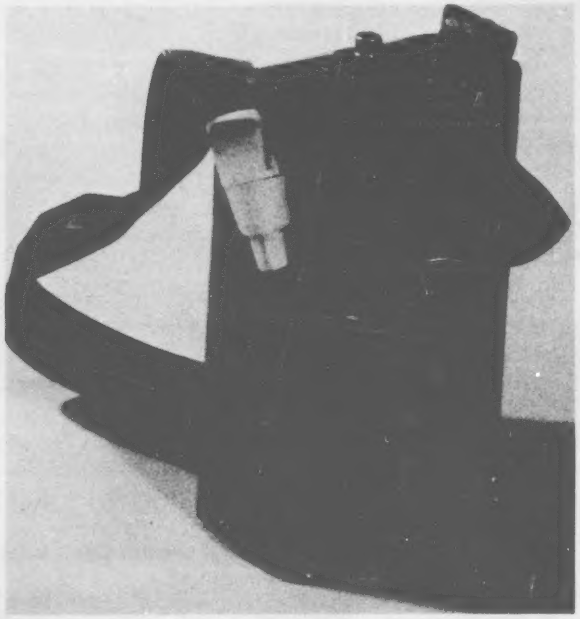

Fig. 24. Model H Pathsounder with auditory display

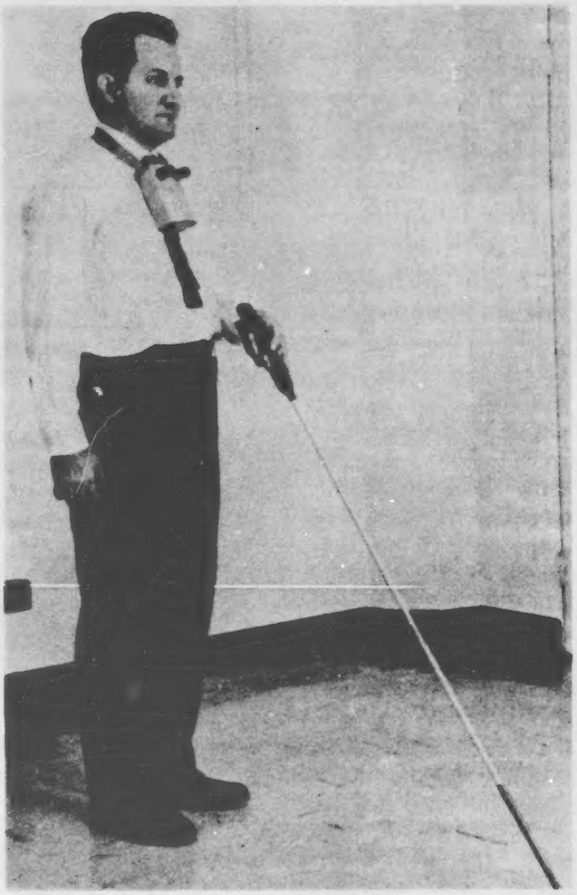

Fig. 25. Vito Proscia wearing Pathsounder and using Hycor cane (side view)

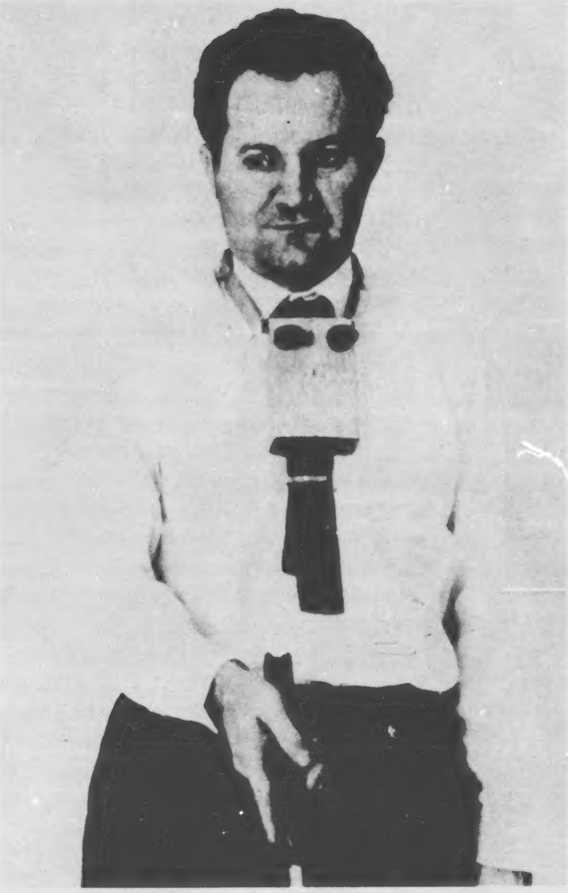

Fig. 26. Vito Proscia wearing Pathsounder and using Hycor cane (front view)

loudspeakers on the neckstrap. The ultrasonic beam explores the area through which the user's head and shoulders will pass in taking the next few steps. In contrast to the Kay aid, which makes the user responsible for a considerable amount of signal processing, the Russell aid assumes that only the existence of obstacles in the immediate path is of importance. Thus, when no object is detected within 6 feet, no audible sound is emitted by the device, but as an obstacle enters the 6-foot range, a buzzing sound is broadcast. The buzzing becomes louder at closer ranges until at 30 inches the signal changes abruptly to a beeping sound (Fig. 27).

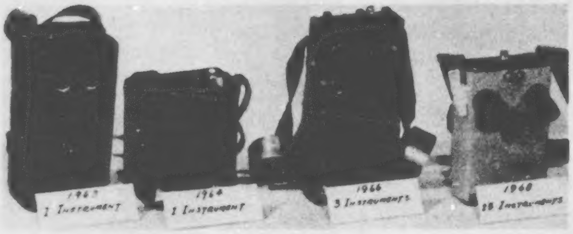

Fig. 27. Pathsounder evolution

Deployment of Pathsounders in the field has been effected through mobility instructors, who have functioned as intermediaries between the technical developers and the blind end-users. Most of the applications have involved clients with out-of-the-ordinary problems; e.g., blind wheelchair users, cane-travelers with faulty obstacle perception due to hearing loss or imbalance, and those with injuries requiring extra upper-body protection. In several cases normal cane-travelers (i.e., persons without a handicap other than blindness) found Pathsounders helpful when their daily routes involved city travel on heavily crowded sidewalks.

A vibratory version of the Pathsounder has just been completed (Fig. 28). This version has two vibratory signals. The unit itself vibrates when a signal is in the outer range, and a neck-mounted vibrator signals a target in the close range.

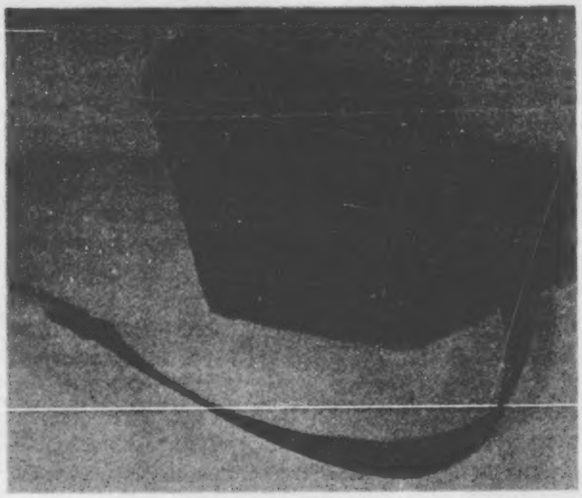

Fig. 28. Model E Pathsounder, an electronic mobility aid with vibratory display for both the blind and deaf

Availability of Aids

Several devices that are useful to the blind or deaf-blind have been discussed. Only a very few are available either directly to the user or through some agency. How can we change this situation? The lessons that we must learn include the following:

1. The planning for aids and appliances for the blind and deaf-blind requires a considerably better understanding of the basic demography and sociology of blindness, deafness, and deaf-blindness.
2. The problems of sensory aid development do not lie exclusively in the technical area but intersect many disciplines. Therefore, for their solution, these problems require well-integrated research programs. They cannot be approached in a piecemeal fashion.
3. Evaluation plays a role of greater importance in the process of sensory aid research and development than is customary in industrial research and development. This fact must be acknowledged both in terms of appropriate funding procedures and in the provision of the necessary facilities within which these activities can be more closely integrated. The establishment of a national center for sensory aid research may ultimately be the most efficient way of meeting this need.
4. The fragmentation of effort fostered by the policies of the funding agencies must be avoided. Greater efficiency could be achieved if national objectives were established and a coordinated program were developed.
5. Solutions to the problem of providing prosthetic aids for the handicapped can and must be sought with greater resolve and in more diversified ways. Furthermore, meeting the needs of the handicapped must be recognized as each person's responsibility. It is in acknowledging this simple fact that the major challenge really lies.

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Programming for and Rehabilitation of the Low-Functioning, Nonambulatory Deaf-Blind Child

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Only in recent times has there been a concerted national effort to redirect the education of professionals and subprofessionals to serve the retarded, and to establish facilities for the assessment of techniques and practices. In 1964, the United States Congress enacted legislation (Public Law 99-164) and provided funds for construction of university-affiliated facilities for the mentally retarded. These centers were commissioned to serve as education and training resources to develop manpower to cope with problems related to mental and developmental disorders of children and young adults.

The Center for Developmental and Learning Disorders (CDLD) at the University of Alabama in Birmingham is one of the first of these resources to be completed and put into operation. It represents a significant new hope for the future.

The CDLD has an experimental project. The project, known as the Demonstration Laboratory for the Early Stimulation of Handicapped Children, was established in September, 1970.

Project Goals

From its inception, the project has had the following four goals:

1. Train students and staff in the care of physically handicapped, severely and profoundly retarded children from birth to seven years of age.
2. Train parents in the effective use of behavior management and developmental stimulation techniques in the care and management of their retarded children.
3. Support parents in the care of their retarded children so these children can stay at home as long as possible. A mothers' group meets weekly, and many hours are spent on the telephone and in the homes talking with the parents.
4. Improve certain gross and fine motor and self-help skills of severely and profoundly retarded infants and young children.

The project staff is made up of Betty Bell, director; Charmion Hain, special education teacher; and one teacher aide. The project staff works very closely with physical therapy, nutrition, and speech and hearing specialists and can request consultation from any other discipline as needed.

For the first three years, the program operated nine months a year using volunteer mothers to complete staffing needs. During the summer months, all of the equipment was loaned to the parents, along with specific instructions on how to work with the children.

Two sessions meet three days a week. The morning group is made up of six children under four years of age, and the afternoon group has seven children four to seven years of age. We feel that we have reached a maximum as far as the number of children is concerned because we have found that a one-to-one situation is required to avoid a day-care setting.

The original plan was that the children would remain in the program until the staff could place them in a community facility or until they reached the chronological age of seven years. Unfortunately, Alabama is extremely far behind in providing day-care, nursery, or other facilities for retarded children, particularly children in the severely and profoundly retarded group. The staff has been able to place three children in special day programs for handicapped children. When these children left, they were ambulatory, partially toilet trained, and able to feed themselves with a little assistance.

Project Plan

During the summer of 1970, Director of Nursing Nancy Patterson, with the aid of two student trainees, conducted a pilot day-care project at the

CDLD with three severely retarded, physically handicapped preschool children. The children attended the program five mornings a week. The goals were (1) to give the mothers some relief of the physical care of these children and allow them some free time for themselves; and (2) to encourage mothers who received some relief to seek an active part in the day-care program.

In the fall of 1970, the project members decided that they needed some physically handicapped, severely and profoundly retarded infants and preschoolers in the CDLD in a structured program for the training of students and staff. There were 60 or more educable children in the center's school programs, but no lower-level children were enrolled. The nurses saw the lower-level children in homes, hospitals, and agencies and decided to establish an experimental project to determine what could be done for these children and their families. Thus, the Demonstration Laboratory for the Early Stimulation of Handicapped Children had its beginning in September, 1970. The three children in the summer pilot project were included in the new laboratory.

Selection of Patients

Thirteen children are enrolled in the laboratory. The children are selected on the basis of the following criteria:

1. Level of functioning must be in the range of severe or profound retardation plus a physical handicap.
2. Children must be in the age range of birth to seven years.
3. Parents must demonstrate cooperation by being able to bring their children to the center each day.
4. Mothers must be willing to work one day per week in the laboratory, if they are not employed outside the home.
5. Each child must come through the CDLD referral committee and have a complete evaluation by team specialists in medicine, nutrition, physical therapy, social service, dentistry, nursing, and the like.

Collection of Baseline Data

The actual training and stimulation does not begin until each child has been observed for at least a week, baseline data have been obtained, and movies have been taken. Various developmental screening tools are used: the *Denver Developmental Screening Test*, the *Vineland Social Maturity Scale*, the *Developmental Profile*, and the *Project Memphis Scale*. We use a battery of screening tests to familiarize the trainees with various tools. Neurological assessments are made by the physical therapist. Such factors as neurological status and physical and psychological readiness for various tasks are evaluated.

As each child enters the project, the parents are asked to list the behaviors in their child they would like to see altered and the skills they would like to see developed. The parents are also asked to list those things they feel might serve as effective reinforcement for their child. On the basis of the parents' statements and the team's observations of the child, initial goals are identified for each child. These goals might be the development of head and trunk control, balance and righting reactions, reciprocal leg movements, fine motor skills, and language; or the improvement of self-feeding skills.

Briefly, the techniques employed in this project are derived from reinforcement theory in psychology and neuromuscular development theory in physical therapy. We consider the knowledge of sequential development to be the basis for all of our program planning.

The basic rule in the stimulation of neuromuscular development is to work to achieve normal involuntary responses rather than voluntary responses at first. An attempt is made to overload the child with stimulation so that, because of the buildup of input, the body responds with the normal reflex, which is the involuntary physiological response. For example, in the past, if a child could not balance in an upright position, he or she was encouraged to voluntarily pull himself or herself back to midline. Now, rather than working on balance, the child is placed in a situation where he or she gets such input that the involuntary responses are stimulated, and these are the responses that the staff wants. Various types of equipment are used to stimulate balance and righting reactions: infant swing, hammock, tip-and-rock chair, bouncing horse, barrel, balance ball, and adapted tricycles. A child is rolled on a balance ball, rocked in a tip-and-rock chair, and bounced on a bouncing horse; these activities cause an overload of stimulation to the child's righting responses. This method can be used with retarded children because it involves involuntary physiological responses rather than cognitive responses.

Originally, the children were frightened of any moving play equipment. Their balance was so poor that the slightest movement frightened them. Gradually, their fears began to fade and their responses improved.

Many disciplines have used the laboratory for part of their students' or residents' training. In addition to nursing students, students or trainees from physical therapy, nutrition, speech and hearing, special education, vocational rehabilitation, social services, psychology, and medicine have worked in the laboratory. The students have worked with the children and parents, and several students have set up long-term behavior modification projects with the children.

Case Histories

Now that we have given an overview of the program, we would like to describe two rubella deaf-blind children. Their birth dates are within three days of each other, and their disabilities are much the same. Sandy has lost the sight in one eye and has light perception in the other. Rick has light perception in both eyes. Each child has a profound hearing loss. Their physical therapy evaluations were similar except that Sandy does not have shortened heel cords. Both have extreme feeding problems. One acts as a control for the other and demonstrates dramatically what early intervention can do.

Rick represents our control. Let us give you the findings from our first home visit, which was in September, 1973. Rick presented a fairly classic picture of a post-rubella child. He was very small for an almost six-year-old child, and he had the eccentric eating habits that most rubella syndrome children display. He was eating strained baby food only and taking milk from a bulb syringe. He frequently vomited during meal times and apparently could gag himself with great efficiency. We had asked his mother to plan to feed him while we were there but did not observe his gagging or vomiting. The mother explained that he was eating very well that meal.

Rick was very happy—giggling, laughing, and kicking most of the time. He occupied himself by doing a lot of light play with his hands. He showed no desire to move about and would remain in his rocker until he was moved to the pallet. On the pallet he was relatively immobile, staying on his back. He did not cry the entire time we were in his home; however, he did display fear by clinging to the person holding him whenever an attempt was made to put him in any other place than his bed, rocking chair, or pallet.

Rick had numerous illnesses that required hospitalization. With each illness he regressed, mostly in the gross motor area. At one time he was pulling up in his crib, but he no longer does this. Of course, he has such shortened heel cords that he can only stand on tiptoes, and this, we are sure, plays an important part in his lack of interest in standing.

The parents had been on the medical merry-go-round for many years with this severely handicapped child and had gotten little encouragement except during the time he was involved in the Doman Delacato Program in Mobile Alabama. He was taken out of that program at the end of six months because he showed little or no progress. It would seem that, with a great deal of support, these parents and their child could have a much fuller life. The mother must be given some relief, and the feeding problem must be brought under control. Other realistic goals should be established, and a more stimulating environment should be provided.

Sandy, like Rick, was quite small and had experienced numerous illnesses requiring hospitalization. She was usually on her back doing a lot of light play with her hands. Unlike Rick, she was extremely irritable, did not like to be cuddled, refused almost all foods, and had had no fluids for 13 months. She constantly poked her right eye and kept a baby pillow with her at all times. She could scoot on her bottom, but she never pulled up.

Sandy was enrolled in a home program in October, 1971, and she was brought to the laboratory in September, 1972. Since she had no protective responses or righting reactions, many activities were planned to enhance these weak areas. A feeding program was also begun but dropped because the family could not tolerate the screaming that accompanied each feeding session. Work was begun on developing a reciprocal crawling pattern by using a crawling tunnel, reinforcing Sandy with a flashlight when she moved through the tunnel. By the spring of 1973, she was crawling independently and pulling up in the laboratory. She has now generalized these skills and is pulling up and cruising around furniture in her home. She will also walk and climb stairs with one-hand support. Other skills include riding a three-wheel tricycle independently, trailing the wall while walking with a helper, and undressing.

Summary

More benefits could be derived from such a program if laboratory personnel could work on building new skills rather than extinguishing undesirable behaviors and trying to correct additional physical contractures. In that way habilitation would be taking place, rather than rehabilitation at a later time.

Helping Parents to Help Their Handicapped Child

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The key to helping is understanding. My hope is that I can contribute some ideas that will help us better understand the parents of multihandicapped children and perhaps even help the parents understand themselves better. This attempt would be presumptuous on my part unless I acknowledged that nine-tenths of what I will be talking about I have learned from parents themselves. They are the real experts on this subject, and the more we work with them, the more we learn, if we listen and really hear what they are saying.

It is obvious that we need to listen to parents and to work hard at trying to understand them. We need to lend them any support, practical and emotional, that we can because they are the principal resource for the handicapped children who are our mutual responsibility. One does not need to dwell on this point because some of the true innovations and breakthroughs in parent involvement have come from teaching programs for the deaf-blind. Parents have been included as part of the team to help children in centers for the deaf-blind.

Only the framework for the point of view I wish to present is theoretical. The bricks and mortar come from real life. The framework to which I refer is the theory of grief and mourning as we now understand it. Only recently have detailed studies been made of the process of grief and mourning. It is not an attractive subject, and for a long time it was avoided by researchers. In recent years, however, serious attention has been paid to this topic by psychiatrists, psychologists, and sociologists. My orientation is drawn largely from the work of John Bowlby, an English psychiatrist who has devoted many years to the study of attachment and loss. Interestingly, his focus on the grief process came from his observations of the reactions of young children who were for various reasons separated from their mothers. Since then, the work has been expanded to include studies of adults of all ages and their reaction to any significant kind of loss.

Reactions to Loss

While people are different and react in their own individual ways, similarities exist in the patterns and in the emotional processes we use to cope with the common problems of the human condition. Realizing that these patterns exist and looking at their usefulness in adaptation may help us to make more successful adaptations. In addition, we may become more accepting of ourselves or of others when we are aware of these normal, perhaps inevitable, reactions.

Why would one select grief and mourning as a framework? Certainly the parents of the multihandicapped child grieve for the child, for his or her suffering, frustrations, and handicaps. They also, and with every right, grieve for themselves and the burden that the care of the child entails. Back of that, however, is mourning for the loss, the loss of the child-that-might-have-been. We ordinarily think of mourning in connection with the death of a loved one. This loss, the loss of the child-that-might-have-been, has many similarities. All mothers and most fathers dream during pregnancy of the child to come. Hopes, fantasies, and wishes are always there and vary with the individual, but one constant element is that the baby will be all right. The first question most mothers ask after delivery is whether the baby is all right. So the loss we are talking about is of that "all right" child.

The stages of normal grief and mourning are (1) protest; (2) despair; and (3) detachment. With resolution of some of the grief comes a reattachment process, a reattachment to people and activities and things that give life meaning. My experience with parents of severely handicapped children leads me to believe that the parents pass through all these stages but not in an orderly sequence, rather a moving back and forth among the stages in response to changes in the child as he or she gets older and in the situations they confront and try to work out or accept.

Stage of Protest

The stage of protest may take the form of denial: "It can't be true!"; or of anger: "Why me, why our child?" Parents may not hear what doctors and other persons are telling them, and they may continue to search for other answers. The anger can be directed in many different directions, blaming many different people. The denial can be shown by looking for signs or proof that the condition is not what they have been told or that things will be different and better at a later time. The searching can consist of going from one specialist to another, from one center to another, looking for someone who will give a different answer, one that is more bearable. The professional workers in the field used to deplore this going from place to place, looking for a different answer. They felt that it was a waste of time, energy, and money that might be used to better advantage for other things. Now, however, I think most of us realize that this search is valid. For one thing, the family may find a better answer. Even if they do not, however, the search may be a necessary process that that particular family has to go through before they can begin the next phases of dealing with their problems. Any of these protest reactions have a purpose and use. Anger is an unpleasant state, but it does mobilize us for action. It makes us get going to try to do something. It gives us courage that we may not have known we had. Denial and blaming others can be a way of giving ourselves time to recover from the blows we have received and of softening those blows. If the reaction is not continued too long, it is not necessarily harmful. At any rate, we who work with parents have to accept the fact that that is where these parents are and to understand the meaning that it has for them.

Stage of Despair

The next stage has been called the stage of despair. The usual feelings are those of being overwhelmed and of giving up. Apathy, fatigue, and hopelessness are frequently experienced. A previously very well-organized person may show signs of disorganization, inefficiency, or poor coping ability, sometimes described as "coming unglued." Self-blame is common, and problems are seen as even worse than they are. Feelings of guilt may not be expressed and yet are usually present, perhaps at an unconscious level. Feelings of helplessness and hopelessness are somehow, in our culture at least, guilt producing. We are not "supposed" to give up no matter what the stresses are. This is a very painful stage, and yet it has a purpose and seems to be needed as a kind of moratorium, a period of letting go in order to gather strength to move on to another way of managing, or trying to manage, one's life.

Stage of Detachment

A third stage of grief and mourning is the stage of detachment. Preoccupation with the handicapped child is no longer a 24-hour-a-day matter. (This in itself can cause guilt.) Some of the emotional investment is withdrawn from the child, and the person may become quite self-centered, self-absorbed. A person may appear to be concerned only with his or her own distress or with his or her own needs, which again in our culture can bring on lots of criticism from relatives and friends. If the detachment can be seen as a phase and as an essential mechanism for enduring intolerable pain, it can and should be accepted noncritically. Support should be provided for the person until this usually self-limiting stage has been passed through.

Reorganization

The outcome to be hoped for is one of reorganization, or reattachment to loved ones, including the handicapped child. The regaining of previously operating coping methods and of the capacity for enjoying an adult life (of which parenthood is an important part but not the whole) is to be expected, and the efforts of helping persons should be directed to this end. Many parents of handicapped children find satisfaction in learning what can be done for the child and in working actively for the maximum development of that child, as well as working in organizations and for causes that will help other children as well. The gains that they see in their own child's development, even when they are not large, can be a source of continued motivation. Working for better public understanding, better facilities, and improved funding can bring increased self-esteem and confidence. One woman said to me recently that she did not need these trials to improve her character, and I am sure we can all agree with that attitude; however, it is true that we do feel good about ourselves when we can meet and overcome what seem to be insurmountable obstacles. In psychiatry, we talk about "grief work," which is not mere phraseology. Grief is work, and work helps resolve grief. Activity can be therapeutic in itself, and activity that accomplishes worthwhile results is certainly therapeutic.

As I said earlier, my strong impression is that parents of multihandicapped children do not move through the stages of grief as separate sequential phases but instead may move back and forth within this continuum. Sometimes apathy will be followed by anger, which will be followed by hopelessness, which will be followed by denial. The important thing is that all of these reactions have a purpose ultimately to help the person adjust and function in the best way that he or she can.

Because we are not superhumans, all of us carry around with us some unresolved angers and sorrows, and, for people who are under some degree of continuing but changing stresses, the probability of rapidly fluctuating reactions is high. One of the things that amazes me when I am talking with parents is how responsible they feel for their emotions. My position is that we are responsible to a large extent for our actions and our behavior, although there are times and situations where maintaining this control is difficult if not close to impossible; however, we are not responsible for the way we feel. Feeling is an "is," not a "should."

Feelings are what they are for very good if not always understandable reasons. If I am angry, I am angry, and whether I should be angry or not is very much beside the point. Now what I do with that anger is my responsibility, whether I express it in words or by throwing something, or whether I take it out on the person with whom I'm angry or on my dog or on myself (a not infrequent way of handling anger). I think we should expect people to do the best, most constructive things that they are capable of doing; however, it is futile for us to expect them to feel any certain way or for them to expect themselves to stop feeling one way and start feeling another. I have seen many people become more at ease and able to function better when they are given permission to stop feeling guilty about how they feel. Their energies then can go into the things they have to do rather than be used up in suppressing or being guilty about their "bad" feelings. Feelings can be changed, but that is hard and long work which begins with knowing and owning up to the feelings that are there. Professional workers in the field can certainly help with this process by being truly accepting of where the parent is in adapting to his or her role. Setting the example of acceptance will facilitate the person in accepting himself or herself for what he or she is and where he or she is at this point, with the realization that he or she will be in a different position later on.

Case History

Another very important goal when there are two parents is for them to try to be in the same place at the same time or to understand and accept the differences in their positions. Let me tell you about a couple with whom I have been working for several months. They have a seven-year-old son, Eric, who is normal and a four-year-old daughter, Jolene, who has multiple handicaps. The mother was referred to me for individual psychotherapy because she was having episodes of rather alarming depression. Attractive, intelligent, extremely conscientious, she gave everyone the impression of self-assurance and competence. Inside herself she was living with despair. Anger was present also, however, and I began trying to get that out where we could work with it. As it happened, she was no longer angry at fate or at the child, but angry at the long procession of doctors and other professional workers whom she had consulted through the four years. Her cry was "nobody ever really helps." In her view, she had been asked endlessly to give information but repeatedly had received evasive answers, meager information, and false reassurances. Back of this anger at professionals was anger at her relatives and at her husband because they did not provide the emotional support or the relief of sometimes taking care of the little girl. They seemed to be saying "You're her mother. It's your responsibility. She needs to be with you and, besides, she is not all that hard to take care of."

Jolene is a child who behaves quite well with strangers or in the multiple training and treatment situations away from home. At home, where presumably she feels safe about letting her feelings go, she can be a "holy terror." Her temper tantrums are so severe at times that she is out of contact with the people around her. One day, Jolene's mother, trying to get her daughter ready for a trip to a clinic, with one of these tantrums in progress, finally bundled her up and took her, still in the rage reaction. *Then* the clinic staff realized that Jolene was at times very difficult indeed to work with. But what about the father? He knew Jolene at home. He had certainly seen her at her most protesting times and sometimes had worked with her, trying to calm her down. Throughout these years he had remained in the position of denial. Confronted with some of her most stubborn behavior, he maintained to himself as well as outwardly that she was pretty much all right: "She is just my little girl, much like any other little girl." The denial was helpful to him, in providing some equilibrium, to keep going as the breadwinner, and doing many of the right things as a husband and father. The denial was, however, contributing significantly to his wife's despair. "If I can't even get through to him, then I can't expect anyone to believe how hard my life is and how overwhelmed I feel with my responsibility," she would say.

As this difference in their positions became clear, I changed from individual work with her to work with both parents as a couple. The father has been able to give up some of his denial, to become much more of a partner in working with Jolene, and to become rather fiercely his wife's protector and champion against criticism from members of her family. This has helped her immensely and has been beneficial to the child.

Conclusion

The poster I currently have on my office wall bears the legend, "The greatest kindness we can offer each other is the truth." The truth is not easy to come by. It is often hard to know what is the truth about ourselves, our feelings, our motives, and it is sometimes hard to face what seems to be true. It is hard to be truthful, precise, and detailed about a child's handicapping condition; however, smoothing over or reassuring the parents when reassurance is not indicated can cause more harm than the harshest facts. For parents to know the truth about their child and about themselves is a gift that we may be able to help them obtain– if we and they can be strong together and care enough.

Interpersonal Aspects of Intervention Strategies in the Rehabilitation of Handicapped Children

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Treatment and Habilitation Programs for the Congenitally Handicapped

In the past nine years medical people, educators, and paraprofessionals have been working diligently to meet the challenge of service to a population of multiply disabled children. A great body of knowledge, theory, and techniques has been collected. Real services have been delivered. We are coming close to a comprehensive understanding of the developmental dilemmas of the deaf-blind child and have come a long way toward providing adaptive solutions for those dilemmas; however, gaps still exist in the habilitative strategy. One factor that has been touched upon, but which awaits real attention, is the dynamics and stages of the psychological crisis for the parents. Very few services are available for remediation or prophylaxis in that sphere. We have speculated and conjectured superficially on the responses of parents to the handicapped child and on the nature of the crisis experience. We are beginning to understand the normal mourning process, and to initiate for the parents services that will provide them with the opportunity of working through this central issue of habilitation. The intrapsychic processes related to this life crisis must be clearly addressed. My intention in this paper is to look, not only at the dynamics of the parent, but also at those of the intervening professional. I want to look at the parent-professional relationship as a dyad, a two-person unit treated theoretically as one: a unit in which the defenses of both parties are involved in the interaction.

Parent-Professional Relationship

Some of the factors that are operative in the dyad are the parental feelings of anger, protest, despair, and detachment; the defenses used to counteract these feelings; and the deflection of these feelings to seemingly inappropriate persons or situations. Certain other defenses generally related to the preservation of the professional stance are also operative and pathological insofar as they interfere with the potential productivity of the dyad. I am assuming that the parent-professional relationship is seen as the crux of the habilitative strategy, that the habilitation program succeeds in direct proportion to the degree that difficulties in that relationship have been worked out. Concentration on the vicissitudes of this relationship is long overdue. If the defenses remain operative, or if they are not understood, most of what goes on between parent and professional will be in the service of themselves, and only a small portion of the effort will filter down to the children themselves.

First we need to consider carefully the following questions: Who is determining what services are to be rendered? What is the basic philosophy that underlies and determines the nature of these services? Let us answer the first question—who is it? Federal administrators determine the fiscal priorities. The regions themselves have advisory committees, and there is great variance in the degree to which parents are included. Without belaboring the point, we would agree that professionals and administrators are determining what services are needed. We also know that committees of professional persons are developing the individual curriculum for these children. Let us examine the philosophy that underlies the determination of services and curriculum. Are services determined and provided with an underlying philosophy of achievement or with a philosophy of adjustment? As for achievement, we talk a great deal about developmental levels and scales, tasks, measuring, and attaining the highest potential. What potential? Whose potential? What price potential? There is a potential for going as high as possible on a particular developmental scale; there is also a potential for a sense of self-worth and acceptance, personal satisfaction, and personal adjustment within an individual family life-style.

Family-Defined Goals

How often do we prescribe services and develop curriculum on the basis of the individual child's well-being and adjustment, within the framework of his or her own family? The family, after all, will be with the child long after the developmental scales and the educators are gone. How many children have been in school for five years, have gone ten steps higher on the *Callier-Azusa Scale*, and then have been institutionalized because adjustment to the family life and priorities has not been seen as the framework or context of potential? To put it bluntly, the family has never been asked "Where do you hurt the most?" Goals for the individual child have been externally defined. The real message to the parent when this goes on is: "We know better than you. We know best." Striking psychological correlates exist between this message and the act of institutionalization, and parental conflicts over institutionalization need to be, but seldom are, carefully worked through. Of course, it is possible that the professional does "know better" in certain respects. Certainly, the services of the professional enhance the possibility that members of the family will reach family-defined goals based on their own values. But too often the attitude "we know better" is communicated right away, with no facilitation of the family's own clarification of goals. Only when the facilitation process has been worked through can the family make use of what the professional has to offer; only then the professional resource can be used. The message "we know better" frequently activates defenses that prevent the family from coming to its own conclusion that the professional can be of use. Now, in order to allow the family to find its own way, culminating in the ability to make use of help and resources, we have found that the intervening professional must be aware of his or her own defenses. Without this, communication will, and we have certainly seen that it does, proceed oppositionally.

Why is there a tendency to impose our own ethic upon the families we propose to serve? Perhaps because we too are imposed upon to struggle for achievement; that struggle may lead us away from our deepest personal satisfactions. The philosophy that places high priority on certain kinds of achievement, based on the middle class ethic, would have us take the multiply handicapped child from his or her potentially nurturant, family milieu, and have us deal with him or her as an isolate, to be shined, polished, honed to his or her peak potential–using our own norms. Our tendency has been to plaster tasks and developmental strategies upon these children with very little attention to the difficulties in their most basic milieu, their interpersonal life. We frequently say, in our frustration in working with parents, that the parents do not hear. Not only is the professional community establishing the goals for these children and determining services, but the professional community is also devising the evaluation instruments that measure the effectiveness or worth of any particular service provided to attain these goals!

The family's efforts to clarify goals can be facilitated and enhanced by informed professionals whose characteristics are that they are not intrusive nor prejudicial, nor judgmental, but facilitating, clarifying, and enabling. This facilitation should be available from birth through the early family trauma and early family-infant interaction. Only when we think as facilitators, rather than authorities or superegos, can we truly meet the needs of the parents, the family, and the child rather than our own. Before proceeding to specific examples of difficulties in the dyad, I would like to take time out to read for you the goals of one anonymous mother as she wrote them:

"Someday" Goals I Wish for My Child

1. I wish, foremost, for my child to be happy. If he can be that, living at home (and I am still able to care for him at home), fine. If he wants to live away from home, then I must provide a place for him to live–not just exist.
2. I wish my child to be educated to the extent of his abilities and capabilities of using his education. I would not like to see him be a doctor who would never get a patient, say.
3. I would like him to have enough daily living skills so that he will not fear he is a great burden. I would like him to be able to wash himself (at *least* the parts a grown man would not like his mother to wash), toilet himself–I will not be able to take a grown man into the women's restroom. Brush his own teeth and assist (at least) with his dressing. (A grown man would not like his mother to put his underwear on him.) Also shave himself and put on his own deodorant.
4. I would like to see my son continue to be happy with himself, so that others will continue to be happy about being around him. He should also learn to be gracious about asking others to help, so that they will want to, and he should be proud enough to ask for help only when he genuinely needs it.
5. I would like to see my son be content in using his leisure time wisely. If he feels he must work outside, then I would like to see him do something of service to his community.
6. I would like companionship for my son, both with normal men and women and with other handicapped people. I would like a place for him where he can go and meet new friends and see old ones,

to talk, listen to music, bitch when necessary, and whatever else young people will be doing then (short of doping themselves).

7. I would like my son to have an appreciation of beauty. To be able to choose that which is good over that which is valueless. To be able to see the good in everyone around him, and not be afraid to voice what he feels.
8. I would like my son to pick up after himself, to put his clothes where they belong, his belongings away, etc. I would also like to see him be able to do simple chores around the house.
9. I would like him to be able to maneuver himself at *least* enough so that I will not be afraid to leave him alone for short times. He should be able to get himself out of the house in case of an emergency, such as a fire, if I am gone. I would also wish him to be able to recognize an emergency and be able to think what to do about it, and how to do it.
10. I would like him to be able, when he goes to a doctor, to tell the doctor what is wrong—where it hurts, and what the symptoms are to make him want to see the doctor.
11. I wish to God I knew how to help him accomplish these things. (This goal is the real challenge to the curriculum developer.)

Interpersonal Feelings

Now I would like to offer further hypotheses regarding the origins of pathology in the parent-professional dyad.

We have words, and we have actions. These are the most readily observable aspects of our communication. But to complicate matters, we also, each of us, have individual values, stereotypes, and prejudices. We evaluate our own feelings and reactions and those of others. Underlying these individualized factors are our attitudes and feelings, which are less perceivable. These deeper attitudes and feelings that make up our personality have been formed long before we became parents of a handicapped child, long before we became husbands or wives, long before we became professionals working with handicapped children and their parents. All this adds up to the fact that our work with the handicapped child has a different meaning for each of us; that personal meaning or significance has the utmost influence on our communication. When meaning and the feelings associated with it go unrealized and unresponded to, the implications are vast as well as ominous.

Some of our feelings are known to us, and some are not. Some are too painful or frightening or uncomfortable to know; we push these away, out of our awareness. When we find it necessary to ward off painful feelings, our real needs must go with them. We are rendered incapable of communicating those needs and of having them correctly understood and met by ourselves and others. If one cannot acknowledge the existence of a pain, one cannot very well talk about it and get effective help to remedy it. One cannot even use one's own resources to cope with it.

Now, let us consider the way parents express themselves. I would like to talk about this within the context of what I call "labeling." Often we hear parents described in single words, which act as labels. One commonly heard label is "overprotective." Another is "nonaccepting." Usually the behavior that typifies the label is looked upon scornfully, is seen as a nuisance, rather than as a symptom of human pain. Consider what is behind the behavior of the "overprotective" parent. Could it be that a parent acts overly protective in order to assuage a painful sense of guilt, failure, or helplessness? Could it be that overprotective behavior is a defense against the parent's legitimate but intolerable rage? Could it be that a parent is "nonaccepting," "rejecting," or "denying" because to see the situation the way it is carries with it the threat of deep sadness and mourning? How overwhelming does the parent estimate those feelings to be? And what about rage—the rage that is connected with the fate of life-long caretaking; the offense against oneself and one's child; the financial burden; the daily hour-by-hour rage, when every single step of a daily routine is increased in difficulty; the daily life harassment? How intolerable to him or her is the parent's own rage because of its seeming incompatibility with astute caring of and for the child? And if anger is intolerable where it belongs, to what safer place can the parent direct these intense feelings? Could it be toward the educational system, the medical personnel, the home visitor, the teacher? What does the professional do with it? How comfortable is the professional himself about getting in touch with those feelings, uncovering them, providing an atmosphere in which they can be expressed? How, why, and to what degree is the expression of certain feelings threatening to the intervening professional and how much of his or her energy is spent blocking the expression of those feelings?

To illustrate some aspects of the problem, I would like to tell you of a recent dialogue among professional persons who were discussing their work with parents. A teacher in training asked the master teacher: "What do we do with the parent who gets upset or negative about all the conflicting information he or she has received from the various professionals?" Even in the question we can detect discomfort with the expression of certain kinds of feelings and the need to find a way to control them. The phrase "what do we do with the parent" denotes opposition rather than alignment. It is another way of saying, "what can I do to make myself more comfortable," "how do I control the expression of those feelings," or "I need to control them because of the anxiety that they stir up in me." The master teacher's response was, "The parent should be given some cold hard facts. He should be told the reality, that there is no one answer." This response is intended to settle the feelings of the parent, and *further*, to defend the professional stance. As an alternative, the intervening professional might have aligned himself or herself with the parent by saying, "That must be very confusing," or "That's very frustrating, isn't it?," or "I think I might feel very angry about that if I were you." What keeps the teacher from making such an empathic response is the mistaken notion that an admission of imperfection and a justification of the parent's anger are tied into giving up one's authority or one's effectiveness in the helping role. Of course, just the opposite is true. If the parents are not first understood, they will not hear anything subsequently. In the alternative response, the professional is following the lead of the parents, picking up with the parents where they are, facilitating the expression of strong and present feelings which, if not aired, will block any further attempt at communication. The reality of the situation in question does not wipe out the feelings associated with the reality, and unless the intervening person first recognizes, and is empathic with, these feelings (and only after that, supplies the reality), the communication will break down. The response to the parent could be, "Yes, no one is sure what the right answers are, and that can be very upsetting." The parent will have a sense of being understood, and being understood brings with it the hope and possibility of being effectively helped. The parent will listen because he or she has been heard.

Another example that you will all recognize is: "What does a young teacher say to a negative parent who thinks you cannot be of any help because you have never even had any children (let alone a handicapped child!)? There may be a range of responses on the part of the professional: "I think I may be able to help if you are willing to work along with me." The message here is "If you fight me lady, we'll get nowhere." In such a situation, either the parent's anger increases, or the professional continues to feel he or she can be of help, and the parent continues to feel he or she cannot, but will put up with this well-meaning person. The home visit then becomes an added burden to be met dutifully. The extreme of the professional's defensive response to the parent's charge may be to present his or her credentials as proof of his or her ability to help: "I have a degree in education of the handicapped from such and such institution; I have taken courses in this one and that one; I have worked for X number of years in this or that program for the handicapped." In this case the parent is duly impressed, if not intimidated. The expression of his or her feelings has been effectively controlled. All of his or her past relationships with authority figures are reactivated. Further, the parent may well feel that he or she does not have the qualifications necessary to meet the needs of his or her own child. As a result, the parent's role in the child's habilitation is diminished or abdicated to the professional. This is in direct opposition to the professional goal of engaging the parent in the work. This is always the dilemma; our words and actions may be in opposition to our intended goals. What might have been an alternative response for the professional who is finding it very difficult to get in touch with any feelings of insecurity or inadequacy? The response could have been: "You feel I won't understand how things really are for you," or "You've had a lot of experience I've never had and you're wondering how I could possibly be of any help to you," or "It's true, I won't always know what it's like." The fear is that an acknowledgment of this kind, any slip in the strong professional image, is tied up with loss of influence with the parent. Again, just the opposite is true.

Conclusion

We see by these few examples or tentative hypotheses that the dyad is complex; an interplay exists between factors that relate to the parent and those that relate to the professional. It is not enough for me to simply comment or reflect. A more systematic and thorough approach to the issue is needed. It would seem that the outcome of such a study would call for services that provide therapy for parents, individuals, as well as groups, and some form of effectiveness training or therapy experience for teachers, home counselors, and other professionals in an intervention program. Very few, if any, of the teacher training programs require or even offer course work in this area. Very few, if any, regions offer and urge a consistent program of therapy for the family in crisis. Few, if any, therapists are trained both in psychotherapy and in the remedial treatment and education techniques. The specialized didactic accompaniment is the characteristic of therapy with parents of handicapped children.

Finally, this all brings to my mind the one great remaining omission in our attempt to understand the complexities of development in the deaf-blind child. We still need a concerted research attempt to understand the intrapsychic experience, development, and the unique psychological dilemmas of the deaf-blind child.

Principles of Behavior Management, Discipline, and Child Rearing Based on Three Psychological Theories

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In this talk regarding principles of child rearing and behavioral management, I shall tend to shy away from such terms as "handicapped child" and "deaf-blind child." Although this seminar is devoted primarily to the deaf-blind child, the rules for optimal child-rearing techniques do not differ with the physical status of the child. My point is illustrated, in a sense, by a "Dennis the Menace" cartoon. The cartoon shows Dennis coming into his house with a little black playmate at his side. To his mother, Dennis says, "Mom meet my friend Jackson. He's just like me, 'cept he's different–he's left-handed." We are all left-handed in one way or another. Your children's left-handedness is their specific handicap. The basic principles of behavioral management, however, are the same.

People, even parents, tend to view the handicapped child as a handicap first and a person second. One purpose of this seminar is to point out that every person born deserves certain rights and privileges simply for being born a human. Every human being deserves and must insist upon the basic dignity, worth, and love to which he or she is entitled by birth.

The first thing we learn in parental adversity is that emotional involvement with the handicapped person sometimes blocks the effectiveness of the parent. Therefore, the contributions of both the professional and the parent are necessary for optimal development and management of deaf-blind children. To no one's surprise, being the best parent that you can possibly be is an extremely difficult and demanding job. I steadfastly maintain, however, that that is no reason not to be the best parent you can possibly be.

As the title suggests, I will discuss the theories of three psychological principles related to child rearing and management. After the discussion of the theories, we will discuss specific instances and examples of how these theories can be applied. The three principles are learning theory or why we do what we do, self theory or how we feel about ourselves as persons, and psychoanalytic theory or the process of unconscious motives.

Learning Theory

Learning theory is simply a scientific explanation of how we learn. We can substitute the title "Rules for Conditioning." Learning theory is the study of behaviors and not causes. Learning theorists believe that in many cases treating a direct, overt behavior is more effective than searching for an underlying cause. The behavior or symptom of a problem often is more trouble than the cause of the problem, such as childhood enuresis or psychogenic encopresis. Since treating a problem behaviorally takes much less time than a traditional psychoanalytic approach to exposure of underlying causes, the urgency of a problem may dictate the use of a behavior modification treatment, such as in the case of animal phobia or elevator phobia.

The rules of conditioning are based on a system of reinforcements–reward and punishment. A child will learn to do those things which are positively reinforced, and he or she will learn not to do those things which are negatively reinforced. Therefore, the first rule is: Reward those behaviors that you want to increase in frequency, and punish those behaviors you want to decrease in frequency. The difficulty is determining what are accurate rewards and punishments for a given child. The second rule is: The balance of reinforcement should be on the side of the positive. This rule guarantees that the great potential of positive reinforcement will not be overlooked. Positive reinforcement is more pleasant for the parent to administer and the child to accept. Also, positive reinforcement contributes to a healthier self-concept. Negative reinforcement teaches a child *not to do*, whereas positive reinforcement teaches a child *to do*. It is better to be a *doer* than a *not doer*. The third rule is: Reinforcement should be administered as immediately as possible. The longer the period of time between the behavior and the reinforcement, the less effect that reinforcement will have on the child's behavior. A few seconds may be critical, and a delay of minutes or hours may render the reinforcement totally ineffective.

The most important rule in conditioning behavior is that there must be complete consistency of both positive and negative reinforcement. Three types of consistency are worth considering here. The first type is consistency between persons. If something is all right with mother, it should also be all right with father, grandmother, teacher, and anyone else who has contact with the child. A second type is temporal consistency; that is, what is right or wrong for a child to do must remain constant from day to day. Punishments and rewards are not to be issued on the basis of how the parents feel on a particular day. The third type of consistency involves consistency of what is said and what is done. This principle is most often violated. Only when parents are 100 percent consistent can the child learn to expect the appropriate reinforcement for a given act.

Two additional rules of conditioning must be met to ensure optimal conditioning. Parents must be certain they are right when they expect a child to behave in a certain way. Parents must commit themselves to succeeding in these attempts to condition a child. Unless parents are certain that they are right, they have no right to expect the child to behave in a certain way and they will show a lack of confidence to get the job done. This will be noted by the child, and attempts to condition the child will be that much harder. If inconsistency has been the mode, the child will test the rules and limits by trying to hold out over the parents. If the parents are committed to the task, this message will be transmitted to the child. Because a good reinforcement is one that works, one may "up the stakes" or increase the magnitude of either the positive or negative reinforcement, or both.

Self Theory

Self theory is concerned with the way a person thinks and feels about himself. A child's self-concept is most important because that concept or self-image will help determine how the child develops into an adult. A child will act in a manner consistent with his or her self-concept. If the child feels good about himself or herself, he or she will generally act good. If the child feels bad or stupid, he or she will tend to act bad or stupid. Likewise, a child who is less than competent in some areas will, with a good and healthy self-concept, tend to perform better than predicted.

For optimal self-concept development in the child, certain experiences should be provided by the parent. An intimate relationship should exist between the parent and the child. This should not be an overprotectiveness or a physical closeness, but a high-quality interpersonal relationship. The respective parties should feel safe and comfortable with each other; they are aware of each other's feelings and weaknesses, but the weaknesses are not exploited.

Also important in cultivating and maintaining a child's healthy self-concept is to have an unconditional acceptance and an empathic understanding of the child. Parents should experience a genuine valuing of the child and an understanding of the child's thoughts and feelings from the child's point of view. Parents must be willing to have an open, honest, and genuine relationship with their child.

A final point self theorists deem important is that parents vest the locus of responsibility for important behaviors in the child. A child cannot act responsible unless he or she feels responsible and cannot feel responsible unless he or she is responsible. This point holds true in all cases, handicapped or not handicapped. The "important behaviors" are relative to the individual child. An important behavior for one child may be to finish his or her chores in order to earn an allowance, while for another child it may be to tell his or her mother that it is time to go to the bathroom instead of soiling his or her pants.

Psychoanalytic Theory

Now let us explore the contributions psychoanalytic theory has made to the parent-child relationship. One of the basic concepts of this theory involves the manner in which a child handles his or her thoughts and feelings. Being aware of one's thoughts and feelings and expressing them in a socially acceptable manner is psychologically healthy. Problems result when a person cannot express his or her thoughts and feelings, thereby turning them into unconscious thoughts and feelings. These unconscious thoughts and feelings are still expressed but in ways that are usually maladaptive and that may represent symptoms of emotional disturbance.

The child goes through various developmental stages. Rearing practices must be appropriately geared to the child's level of development. At each of these stages, the child has certain needs that must be met if he or she is to adequately progress to the next level. Weaning, toilet training, and other conformative behavioral training should occur late and should be carried out in a lenient manner. This training should occur after the child has shown an ability to perform this kind of behavior. One final and important point can be made from psychoanalytic theory. Parents should attempt to discipline a child for what he or she does and to provide the child complete freedom in the area of thoughts and feelings. Human beings are not really capable of controlling the thoughts and feelings they have; however, they generally can be responsible for their own behavior. A rule of thumb for parents regarding this principle is to be careful to exert responsible control over a child's behavior but allow complete freedom for thoughts and feelings.

Quality Education and Its Impact upon Rehabilitation Services and Their Probable Outcome for Blind and Deaf-Blind Students

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When considering improvements in services to visually disabled individuals, one must keep in mind the following:

1. The congenitally blind represent numerically the smallest segment of the total visually disabled population. Most blindness occurs adventitiously–and generally after the victim's age is such that normally he or she would not have occasion for involvement with regular programs of public education.
2. Blind individuals make up a very small part of the general population. The institutions that have been designed to serve the general educational, employment, or other needs of a sighted world have not developed the capability for effectively serving blind individuals.
3. Blindness presents unique, complex, and subtle problems. The effective amelioration of those problems requires the continuing development and effective utilization of a variety of special skills, techniques, tools, resources, and expertise which from the standpoint of cost efficiency cannot feasibly be developed and maintained within diverse institutional settings.

The average counselor with an employment service agency will encounter only a small number of blind individuals. A local school district may have a limited number of blind students and a special education teacher who is trained to assist such students in deriving maximum academic benefits from the available program. Realistically, however, neither the employment counselor nor the special education teacher alone can effectively assist the blind individual in meeting all of his or her needs so as to develop the capability to function as an effective human being and as a useful, independent, and contributing member of society. Certain vocational training and placement opportunities are of a national scope, and others are of a statewide scope. The local worker in a public employment service agency or the local teacher in an independent school district is not likely to have detailed knowledge of the vocational training and placement opportunities available to blind persons. Certain essential services can be effectively provided only on a statewide level or on a regional basis by a number of states working together cooperatively. If a local school district has only a limited number of blind students, it is not economically viable for that school district to develop the capability for performing a meaningful diagnosis and evaluation of all of the medical, psychological, vocational, educational, cultural, social, and environmental factors pertinent to the blind student's prospects of successful academic and vocational achievement. Neither is it economically feasible for an independent school district with a limited number of blind students to undertake the provision of necessary and highly specialized services, such as orientation and mobility instruction, through the direct employment of qualified staff.

For reasons such as the foregoing, virtually every state and nearly all advanced nations have established an official organization with primary responsibilities restricted to serving the visually disabled. The existence of such an organization serves many practical functions such as the following: centralization of informational services; provision of either formal or informal coordinating capabilities; capabilities for the development and efficient utilization of the specialized skills, techniques, tools, resources, and expertise required for the effective extension of services to the blind; establishment of a specific focal point for measuring the effectiveness of services; and identification of a specific place for affixing accountability.

In Texas the official organization generally responsible for the performance of such functions is the Texas State Commission for the Blind.

Subsection (a) of Section 2a of Article 3207a of the Texas Civil Statutes is as follows:

> In order to promote the greater consolidation of counseling, guidance, restoration, and rehabilitation services to visually handicapped adults and children, the Commission is designated as the state agency having primary responsibility for rendering all services to the visually handicapped except those which are purely of a welfare nature or, in the case of visually handicapped children, those which are provided by the regularly established educational agencies and authorities of the state.

The Commission for the Blind is authorized to participate in all areas of services for the blind and visually handicapped in Texas, except education of a purely academic nature for visually handicapped children and public assistance for all classes of the blind and visually impaired.

The Commission for the Blind makes every effort to ensure that services to the blind and visually impaired are complementary, adequately coordinated, and nonredundant. The commission also provides services that are not traditionally educational in order to improve the opportunity for blind and visually impaired children who may benefit from the educational process. These services are particularly helpful at an early age, when money spent for eye medical care directed toward the prevention of blindness and visual restoration can eliminate or improve a visually handicapping condition. Additionally, family counseling services for parents and siblings may help to improve family understanding and the total family attitude toward the visually disabled child in such a way as to enhance the educational process. Where visual restoration or services designed to prevent blindness are inappropriate for a particular child who has no possibility of receiving benefits from such services, family counseling is of extreme importance to ensure the best possible life situation for a blind or visually impaired youngster of school age. These services are primarily provided by visually handicapped children's caseworkers, particularly through the elementary school years, and by a variety of professional employees, including rehabilitation counselors, rehabilitation teachers, and caseworkers, through the high school grades.

Identification of Children

An important service performed by the Commission for the Blind's caseworkers is that of locating blind and visually impaired children who are either not attending school or who are not of the age to attend school. When these children are located, the information is provided to the Texas Education Agency, Special Education Division. This information is then disseminated to school officials throughout the state in the communities where the children live. This also provides a vital record of the existence and location of blind and visually handicapped children and provides the Texas Education Agency with some basis for the production of teaching materials and text materials for blind and visually impaired children. The relationship with the Texas Education Agency has been exemplary among state agencies, and that pleasant relationship has been of great assistance to the discovery of children who need the services of both agencies and of the local school district; however, the commission can spend only state monies for its services to children. This is because the federal government does not permit federal participation in the funding of children's services even though these services are often preventive or corrective in nature for children with blindness or with a visual disability and even though physical handicaps, if not corrected or prevented, may be potential educational handicaps. This is a major reason why all children with blindness or visual disability as a handicapping condition have not been served by the commission. They may never receive these services unless state funds are increased or federal funds become available, or both.

Visual Problems and Their Effect upon Education

The relationship of the Commission for the Blind and the Texas Education Agency has been one in which the services of each complement the services of the other. The intent of both state agencies has been to improve the situation for blind and visually impaired children, both physically and educationally. The commission, during the past several years, has been able to provide services to about 3,000 blind and visually impaired children per year with approximately 1,000 cases being completed during each fiscal year. A review of the results of these services has indicated that approximately two-thirds of these children have no visual disability at the time the services are completed. The definition of no visual disability, as used in this statement, is "a visual acuity of 20/60 or better with best correction." Most of these individuals should secure a driver's license upon becoming old enough to meet the requirements of the law. This visual acuity also will permit the reading of normal print with little or no eye strain and the reading of newspaper print at varying distances from closer than normal to normal distances.

The visually disabled child, however, who is not reached by the commission and provided services because of inadequate resources on the commission's part will most likely have a handicapping condition that will most certainly be a restriction on the ability of the child to benefit maximally from education, even special education. The literature seems to indicate that approximately 85 percent of the learning that takes place by the individual with normal vision, normal being defined as "20/20 in both eyes, with or without best correction," is by the visual processes. The child born without vision and with no potential for correction–assuming that the process of learning in the blind and the sighted is the same–would be achieving only 15 percent of the amount achieved by a sighted child with normal senses. This, of course, is a false assumption in that it implies that a blind child possesses no other means of learning, such as adjusting to the loss of sight by developing the use of the other senses. Certainly, the use of the other four senses increases in the case of total blindness; and, although those senses are in no way better than the senses in the sighted person, they do become more efficient and, as a result, a great deal more learning takes place than the 15 percent cited above in the totally blind child who is normal in other senses. The degree to which the efficiency of the other senses improves, however, will never come close to offsetting the disability incurred as a result of blindness. Though the ability of the visually disabled child to learn will depend upon the degree of the impairment, the time at which it occurs, the social and family attitudes surrounding the child, and other factors, the provision of services from all available resources will certainly enhance the child's ability to learn. However, visual disability has also been known to create a conflict of roles when the individual is neither totally blind nor normally sighted, and the resulting frustration and stresses, along with the impairment, may render the child unable to make maximum benefit of the amount of vision that exists.

For the adventitiously blinded child, i.e., the individual who is blinded following a period of normal vision, the benefit of visual memory may be very helpful in the educational process. However, numerous variables exist in terms of number of years of sight, circumstances of visual loss, family and social attitudes, opportunities for adjustment, and the many other factors that affect the educational efficiency achieved by the school system in the education of an adventitiously blinded child.

Cooperative Services

These comments are offered as a result of my experience as a blind person and as a result of my observation of blind students in the Texas School for the Blind. I have lived 32 years as a sighted person and 13 years as a blind person. If there is one person who would advocate that education, rehabilitation, or public assistance can do the job required to provide blind persons with the opportunity to function at their maximum level of potential, then I might suggest that some experience in the field would most likely make him or her aware of the fact that such is not the case. One would soon discover that all three in combination are not sufficient to offset the disability of blindness and visual disability to the extent that blind persons are able to function in competition with their sighted counterparts in most circumstances. Even if all of the disadvantages of visual disability could be overcome by services from education, public assistance, and the Commission for the Blind, the added disability imposed by social attitudes, misconceptions, and misinformation would be enough to impose a severe handicap on the blind or visually disabled person. When one, however, adds these additional disadvantages to those problems which are insurmountable in blindness and severe visual impairment, the disability is compounded, and no one agency or program or combination of agencies or programs can offset the problems and disadvantages which accrue as a result of blindness or severe visual disability. Therefore, it is necessary that the Commission for the Blind, the Texas Department of Public Welfare, and the Texas Education Agency work together to do the best possible job in those service areas where responsibility exists to achieve the best possible results. The final responsibility primarily will be that of the Commission for the Blind; however, social services provided by the Department of Public Welfare or contracted to the Texas Commission for the Blind under an interagency contract and educational services offered by the educational system with support and direction from the Texas Education Agency are vital in providing the best opportunities possible for blind and visually impaired residents of Texas.

The services of the public schools and the state-supported colleges and universities, with early intervention by caseworkers of the Commission for the Blind, and the services commensurate with the needs of each individual child complement each other and provide the best possible approach for the blind or visually impaired child in the face of existing funding restrictions. These services can be improved through the involvement of individuals with expertise from both systems and close working relationships between teachers and caseworkers and between administrators of both the commission and the schools. Education alone, however, cannot do the job because, to provide an individual with the training required for work and independent living, the aptitude and interest of the individual must be known. As a practical matter the aptitude and interest of the individual usually cannot be determined prior to graduation from a high school or a school for the blind. Even when aptitudes and interests can be determined before graduation, the time remaining for training usually is inadequate to meet the needs of a blind or visually impaired individual, even if proper training is available. In working as a counselor with blind or visually impaired students at the Texas School for the Blind and at the University of Texas, I have found that the occasions in which an individual was sure of his or her vocational goal were practically nonexistent. The occasions where such was known at the university level, although more frequent, were still less than adequate. As students come nearer to graduation, the number of those who have made a vocational decision with which they are comfortable, even with counseling, is less than would be desired and certainly less than 100 percent. The average sighted individual changes jobs several times before finally finding his or her vocational niche in society. Why should we expect more of the blind or visually impaired individual, and why should we attribute this to our educational system when most likely it is not the fault of that system but rather the result of a lack of maturity and experience existent in most young people?

The lack of vision in the normally intelligent blind child generally sets the youngster back an average of two years in his or her educational progress. The results of reputable achievement tests generally reflect this fact. Perhaps this gap can be narrowed. In all likelihood, however, the loss of vision will continue to mean that the blind child and even the severely visually impaired child will progress at a somewhat slower speed than will the child with normal vision. Therefore, my opinion, based on experience, would be that both education and rehabilitation services will continue to be needed to provide the blind and visually impaired person with adequate opportunity to gain the most from his or her disadvantaged position. Education can, however, complement rehabilitation services; in fact, it can both complement and speed up rehabilitation services.

Improvement of the Educational Approach

Where the total rehabilitation process is limited to education in the traditional twelve-grade system and college, better instructional methods that are more specifically directed than those of a broad academic approach might be helpful for those individuals whose vocational goals can be known before college is completed. For the youngster who does not have college potential, an expansion of vocational education programs for blind and visually impaired students would be extremely helpful in the rehabilitation process simply by providing a larger number of vocational education activities designed to provide work skills where the needs are known and work experience where the needs are not known. A question exists in my mind as to what has been done with vocational education funds, 15 percent of which are supposed to be directed to vocational education programs for the handicapped. Blind and visually impaired students have received little of this funding, and an insignificant number of programs have been designed for their benefit. The job for the most part has been left to rehabilitation. Although rehabilitation efforts have been successful, public education involvement in vocational education for blind students has been inadequate. This retards the progress of the blind individual. As a result of this, the individual requires an extended period of time to gain the skills necessary for maximum attainment of occupational potential.

To expect that all blind and visually impaired persons will attain gainful employment and become self-supporting, however, is an idealistic goal which never will be reached. The existence of other complicated problems related to mental and physical ability and to other factors indicates that there always will be those, both blind and sighted, who will not be able to earn enough to maintain themselves. Unfortunately, the educational system cannot offset these problems, because, as presently constructed, it does not have the capacity to provide vocational training services in the system for individuals who are over twenty-one years of age, nor does it have the expertise to adequately cope with the problem of visual disability in our society as it exists. Rehabilitation always will be needed, and specialized job placement services will be required as long as misconceptions, lack of knowledge, and societal biases and prejudices exist. Under present conditions it takes more than an employment and referral service to secure jobs for blind persons. Even after adequate vocational training has been completed, training on a new job is as important for a blind person as it is for a sighted person.

Sociological Problems and Their Impact

Texas has one of the best systems of assistance to blind and visually impaired persons, both in our educational system and in rehabilitation, to be found anywhere in the United States. More has to be improved, however, than education and rehabilitation for the blind and visually impaired. Idealism in education and in rehabilitation should not be discouraged; however, the programs will be of little value unless they are practical and deal with all of the problems associated with blindness and visual impairment. I submit that the problem today is not one of a lack of services either in education or rehabilitation although both probably could be improved. Rather, the major problems are sociological ones characteristic of many of our own private biases and prejudices. I would submit that in education those biases exist in about the same proportion that they exist in any other sector of society. Except for improvement in the utilization of vocational education for the blind and visually impaired in the public school system and at the community college level, the education and rehabilitation system is reasonably adequate to take care of the blind and visually impaired person's needs related to vocational opportunity and self-reliance. Statutory changes in the form of new or revised legislation may provide a means by which changes and improvements can occur, but I believe the experience with Plan A in special education should indicate to all of us that legislation alone is not the answer. Although Plan A has been in effect for some time, the degree of progress achieved has not been sufficient to implement the desirable conditions envisioned under the plan. The lack of implementation and the reasons behind this lack are not easily discernible; rather, they may be subtle. Idealistically, one might design a program that could cure many of the problems; but realistically, when human beings are involved, many different attitudes and opinions are presented for implementing a program. The process becomes imperfect and often results in too little noticeable change.

Necessity for Coordinated Efforts

The Commission for the Blind will cooperate to the fullest possible degree with the Texas Education Agency and with every local school district in the state to achieve what it believes is necessary for blind and visually impaired persons to secure opportunities to develop to their maximum potential, and it will do so to the ultimate of the authority existing at the particular time just as it has done in the past. The commission does not, however, believe that the educational system will ever be the ultimate answer to the needs of blind and visually impaired persons to the extent that it would be capable of meeting all their needs. With the problems facing the blind and visually impaired citizenry of Texas, skill and techniques are necessary to overcome the problems created therein to the extent that they can be overcome at any one particular point in time. Hopefully, conditions will improve as they have during the last ten years. They are improving more rapidly now than at any time in the past, but the day has not yet arrived, nor do we foresee a time when it will arrive, where rehabilitation efforts of a specialized nature for blind and visually impaired persons will not be needed. We believe that improved education can complement and can accelerate the speed with which rehabilitation is able to work in meeting the needs of blind and visually impaired persons.

I have noticed deficiencies in the public education system in the following areas: health and physical education, mathematics, basic sciences, and vocational education. As a college counselor working with blind and visually impaired students, I discovered that these are the areas where blind college students were deficient either because of their high school educational background or because of inadequate resources available in the college setting. If these areas can be improved, graduates of our public schools and schools for the blind should be better adjusted and prepared. Vocational rehabilitation should, as a result, be made easier. Also, expenses should be reduced because of the shorter rehabilitation process. More people should be served for the same amount of money with a shorter period of time required for each individual and with higher levels of vocational achievement resulting in future years. Although these improvements will not occur immediately, conditions should improve with each succeeding year.

Obviously, the educational system will never be able to meet the needs of every blind and visually impaired person. About one-half of the blind population becomes blind in older age, often past the age of retirement. Another large segment becomes blind after the age of twenty-one as a result of disease, injury, heredity, or other deteriorating condition. This group is beyond the age for attendance in the public school system and very often past the age at which an individual usually attends a college or university. These individuals often have spent considerable time in a particular trade or profession. They face an adjustment process that must be dealt with prior to, or in association with, further education. If the period of time between the last year in school and the time at which blindness occurs amounts to several years, then the likelihood of returning to college in order to continue education is scant, although some do. Retraining often is required, along with a system of personal adjustment training that will enable the individual to cope with the lack of vision and with a new vocation. As a result of the large adult population that becomes blind or severely visually impaired past the normal age when educational programs are usually completed, some major changes in the educational system would have to be made in order to cope with blindness and visual impairment, assuming that one would want to reenter the educational system. Additionally, to reenter under circumstances in which the primary sense has been lost or severely damaged implies that other senses must make an adjustment, and this is indeed a major problem with which many persons will not be able to cope sufficiently. Even if the education process did provide all of the educational programs that an individual would ever need for the rest of his or her life, the adjustment required as a result of blindness or severe visual impairment is too great for many individuals.

An educational system that is expanded to cope with all possibilities that might occur in the future would be costly, extremely wasteful, and unnecessary since the few cases for which such a system would be appropriate would not justify the vast expenditure of funds that would be required for education to encompass the training needed to meet the total anticipated numbers of conditions in which individuals might be involved once they have left the school system. The expenditure probably would not be practical at the community college, junior college, or senior college level due to the cost. Training programs planned to meet the particular aptitudes and interests of the adventitiously blind on an individual basis probably would provide the best approach and would be more realistic in terms of meeting the individual's needs as well as holding down the overall cost to achieve the needed services. Education and rehabilitation, as well as public assistance, obviously will continue to be needed to meet the needs of the blind and visually impaired population. This, of course, does not preclude changes in curriculum, including vocational education, to meet the vocational needs of the severely handicapped. Increased opportunities provided out of vocational education funds designated to be spent for vocational education for the handicapped, with more emphasis upon the severely handicapped, would be a very definite improvement over current methods which tend to overlook the severely handicapped, especially the blind and visually impaired. Perhaps some of this money could be better used if it were designated for vocational education in the Texas School for the Blind. Undoubtedly, as Plan A becomes more effective and more blind students attend their local schools, the Texas School for the Blind will become a school for the more severely handicapped blind children or for those whose family situations do not permit local school attendance. Present efforts at that school are good, but they could be improved and expanded with the addition of new areas of training to provide both experience and development of skills.

Early Diagnosis and Case Finding

Subsection (e) of Section 2 of Article 3207a of the Texas Civil Statutes specifies that the Commission for the Blind is responsible for maintaining a register of blind persons who live in the state. To a great extent this has been accomplished, but under adverse circumstances which relate primarily to the inadequacy of discovery methods of individuals who may be blind, either legally or totally. At the present time there is no statutory requirement for early reporting, either by doctors or by hospitals, of legally or totally blind children. Additionally, the Bureau of Vital Statistics of the State Health Department is not required to report to the Commission for the Blind the death of a blind person; neither is an individual's blindness reported to the Health Department. The requirement, therefore, that a registry be kept of blind persons is an impossible task simply because of the lack of any requirement for reporting the identity of blind persons either at birth or at death. In addition, since the task of serving blind persons is designated to the Commission for the Blind, the commission's ability to render these services is limited by the amounts of state and federal funds available for such services. The adult population is accounted for, but the difficulty of finding newly blinded individuals, either accidentally blinded or born blind, presents a serious problem; and the lack of identity of blindness at time of death also is a severe problem in the process of updating.

This problem not only exists with regard to a registry for blind persons, but also is a severe problem where children are concerned. Without an adequate reporting system, the 1969 statutes requiring that blind children attend public school through the age of sixteen or until graduation cannot be efficiently implemented. Additionally, identification of children at an early age presents a serious problem insofar as early childhood development is concerned, and the resulting preparation for public school beginning at kindergarten also is a serious problem in the prevention of blindness.

The previous comments regarding detection and discovery of individuals who are legally or totally blind indicate the need for legislation that would require reporting of individuals found to have visual impairment or blindness as a disabling condition. To require doctors and hospitals to do this reporting may not be appropriate, but at this point no better method exists. The Commission for the Blind and the Texas Education Agency are willing to cooperate with local school districts in the identification of blind children; however, without some assistance from the legislative authority, many will remain unidentified. Additionally, if an early identification system can be developed by statutory authority, the commission, within limits of its budgetary capability, will be able to provide services to children who may in fact have correctable problems. This will either alleviate present disabilities or eliminate the potential for future disabilities. Thus, the educational potential of these children will be improved, and the efficiency with which their education can be attained will be enhanced.

Education and Rehabilitation Programs

Vocational training for the deaf-blind in Texas has been available in out-of-state facilities for many years. Additionally, the blind have workshop facilities in Houston, Austin, and Dallas. The Commission for the Blind has been actively engaged through its Visually Handicapped Children's Program and through its regular Vocational Rehabilitation Program in serving deaf-blind individuals. The state has identified more than 400 deaf-blind persons. The Texas Rehabilitation Commission has served a few deaf-blind persons, because there is some reason to question which disability is the major one and thus which agency has the responsibility for providing services. Deaf-blind children, unless served by the Commission for the Blind, are not served at all, because the Rehabilitation Commission has no children's program. The Commission for the Blind has always accepted responsibility for serving the deaf-blind, because blindness is the one disability specifically assigned to this agency and it is a major disability in a deaf-blind person.

More recently, the rubella epidemic has resulted in a large number of deaf-blind children who are ten through fourteen years of age. These youngsters are neither totally deaf nor totally blind, but nearly all of them are without functional vision or functional hearing and often they are disabled by heart problems, mental retardation, and other organic difficulties. In 1973 costs for services to 100 deaf-blind persons averaged approximately $2,000 per case. Therefore, the long-term services required for these individuals are indeed costly.

Some attempts to educate deaf-blind persons are being made at the Callier Hearing and Speech Clinic in Dallas, Texas School for the Blind Annex in Austin, Houston Lighthouse for the Blind, and the Austin Cerebral Palsy Center. The programs, however, cannot be considered traditional education programs. A sizable number of deaf-blind youngsters are languishing in schools for the mentally retarded.

When one attempts to teach a deaf-blind youngster who is eight to twelve years of age, a great deal of time already has been lost, and the result has been a simulated retardation by deprivation which may or may not have been partially corrected had services begun at an earlier age. The result has been that most educational programs for deaf-blind children have been along the lines of prevocational training; that is, daily living skills, orientation skills, communication, and the basics that are necessary before one enters traditional prevocational training. The ability to communicate is not a traditional skill, since it varies from child to child, and the traditional communication methods for the deaf-blind are most often less than adequate. Most school programs would not have the resources available to develop the type of program that could be successful with these individuals, since they require a large amount of individual attention and, almost without exception, a one-to-one teaching situation. Thus, services will be long-term, will require a great amount of development and refinement, and will be extremely costly.

The likelihood of employment with sufficient income to support an individual may be years removed in each case. Besides being difficult to find, employment would require knowledge and expertise in many areas other than the job itself. A fertile area in which vocational education might invest a sizable amount of funds would be a facility to provide training that would prepare deaf-blind persons to engage in gainful employment upon completion of the training. A great deal of rehabilitation money will need to go into such training efforts. A cooperative effort would be a laudable undertaking, as well as one which would prove fruitful over the long term. The cost of such an undertaking might not be economically sound; however, one cannot place a monetary value on the humanitarian results achieved from such an undertaking. A great deal of trial and error will be necessary to develop programs that will enable the deaf-blind person to become a contributing member of society.

Education, rehabilitation, and public assistance must all be involved, because the services will be extended beyond the present ability of education. Programs will require state and federal rehabilitation funding. The effort will require the close cooperation and attention of the many state and federal agencies that have complementary services to offer each individual. Coordination will be as important as it has been in services to the blind. If the same cooperation exists without redundancy in services, the only restrictions to the amount of service that can be rendered will be the initial limitation on expertise and perhaps the limitation due to a shortage of funds. No time can be wasted, since every year of delay geometrically increases the complexity of the problem. Funding, which may be woefully inadequate but which in some cases may have been spent for less needy endeavors than vocational education for the deaf-blind, will require a close study and perhaps a sizable increase to meet the needs.

Some study should be given to the possibility of facilities for the multihandicapped population. The needs of the deaf-blind may differ only slightly from those of other groups of severely multihandicapped individuals. In such facilities specialists can deal with the problems which require a particular expertise, but common problems can be dealt with by individuals with general knowledge and expertise in the field of multihandicapping conditions. Not all multihandicapped individuals would fit into such a program, since some will no doubt be intellectually able to cope with education at all levels. These might engage in professional employment or employment that requires great intellectual skill. But for those who are severely handicapped, as are most deaf-blind children and adults, the common denominator may be the multihandicapping condition regardless of its nature.

Although this is not expert testimony in any sense, I am suggesting that perhaps we know too little about the problem at this point to make profound and absolute statements. We may need to look at some alternatives, even if they require modification as we search for a method of providing for the deaf-blind population and for other individuals who may be able to use similar programs. I also suggest that the problem is too big for any one group and that coordination of effort and cooperation are necessary to harness and utilize the many sources of federal funds which often must be gathered by different groups utilizing different matching ratios and different program approaches under different laws implemented by different sets of regulations. Redundancy in services is not a problem and certainly is no reason for creating a cumbersome and uncontrollable bureaucracy that would be offered as a federal or state answer to all types of human services. The confusion that would result in such an organization with massive levels of administration would only lead to the denial of services by exhausting the funds that would otherwise be used for those services. Neither the deaf-blind nor the severely visually impaired person can afford such a disappointment. The approach used in Texas thus far has been more effective than that proposed by federal agencies. If current restrictions on the use of funds were relaxed, we would have the freedom to do the job that conscience requires that we do.

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